

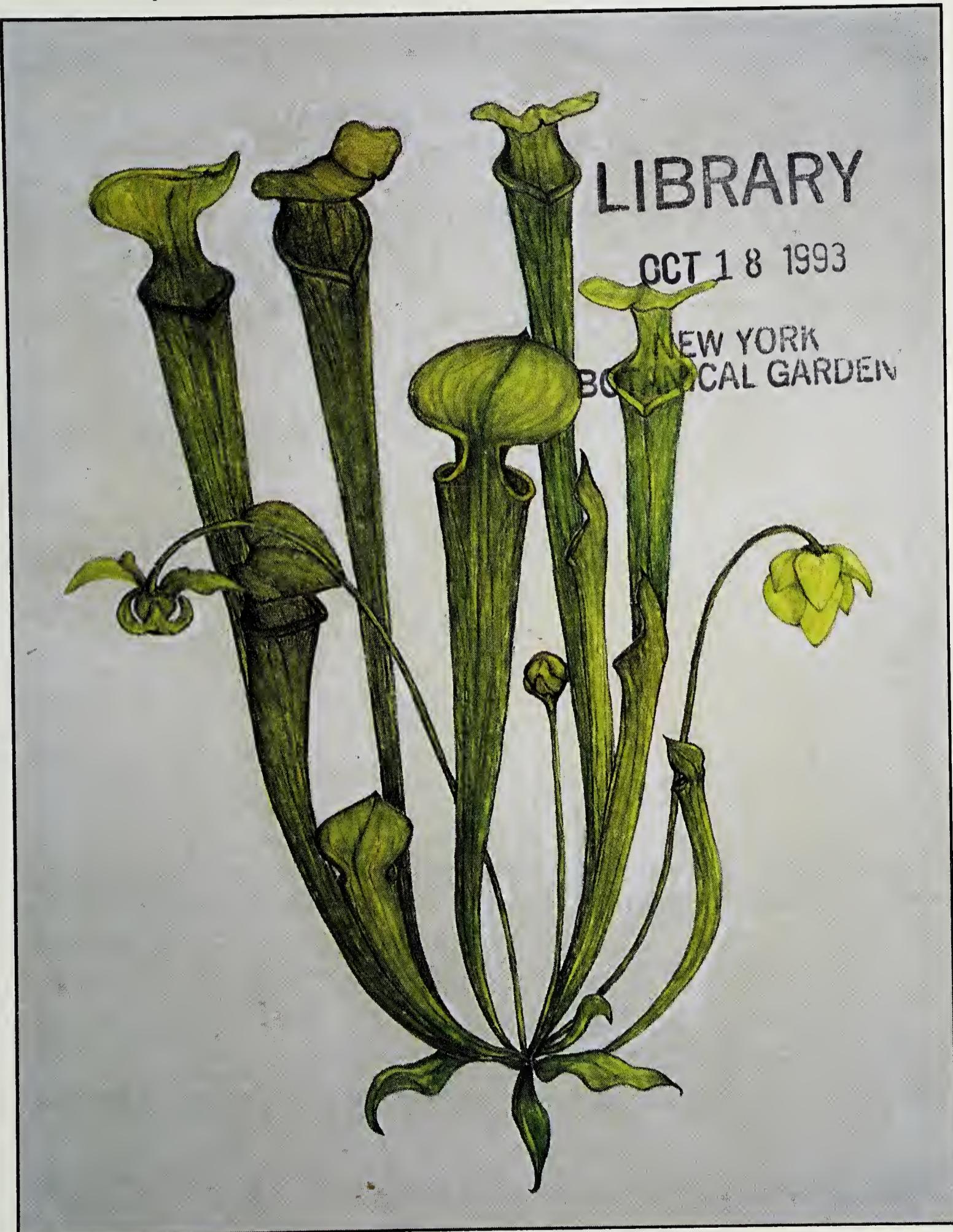
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Tipularia

A BOTANICAL MAGAZINE

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IN THIS
ISSUE

Vanishing Pitcher Plants/2
Pitcher Plant Bog Ecology/10

Bog Conservation/6
Tugaloo Botany/18

Byliners

Bill Close, Advertising Art Director for Rhodes, Inc. for 27 years, now retired, is a regular illustrator for *Tipularia*.

Ron Determann, horticulturist, is the superintendent of the Fuqua Conservatory and Cecil B. Day greenhouses of the Atlanta Botanical Garden.

Vivian Emerson, a long-time Bot Soccer, attends many field trips, delighting participants with her cheerfulness and zest.

George and Debbie Folkerts, biologists at Auburn University, have broad interests in the natural history and ecology of animals and plants. Debbie has studied the relationships between pitcher plants and their prey: pitcher plant moths, spiders and aquatic insects. George is interested in reptiles and amphibians, aquatic beetles, carnivorous plants, and natural habitats in the southeastern U.S.

Lisa Frank is an arts publicist and freelance writer specializing in horticultural and environmental issues. She is the former public relations manager at the Atlanta Botanical Garden and was one of Marcia Cohen's first art students 17 years ago.

Mozelle Funderburk is on the staff at the Fernbank Museum of Natural History. She is a talented maker of museum models and an illustrator of scientific (and science fiction) subjects.

John Garst, Professor of Chemistry, University of Georgia, has a cabin on

Yonah Lake in the Tugaloo Mosaic. In 1970, along a creek nearby, his wife Edna spotted an unusual trillium, leading to a collaboration with George Neece and Wilbur Duncan and the description of a new species, *Trillium persistens*.

Marie Mellinger is a naturalist and freelance consultant. She was a founder of Friends of the Mountains, editor of the *Atlas of the Vascular Flora of Georgia*, and a past president of the Georgia Botanical Society.

Scott Ranger is editor of the Georgia Botanical Society newsletter, an avid amateur botanist and a regular contributor to *Tipularia*.

Gail Russell is president of the Atlanta chapter of the Audubon Society. She coordinates and supports many environmental projects.

Margaret Shannon is a retired journalist and founding editor of *Tipularia*. She is a regular contributor and advisor.

James Sullivan lives near Currahee Mountain in the Gainesville Ridges. He is a boatbuilder, a perpetual student of forest ecosystems and a public lands activist.

Henning von Schmeling is the horticulturist at the Chattahoochee Nature Center with a special interest in bog plants.

Richard Ware is an enthusiastic amateur botanist and photographer with special interests in woody plants and in the flora of Floyd County.

Membership

The Georgia Botanical Society is open to all persons interested in the botany of Georgia. Annual dues: individual or family, \$15; group, \$20; student, \$5. Send mailing address and check payable to the Georgia Botanical Society to Daisy Arrington, membership chair, 6700 Peachtree Ind. Blvd. #B5, Doraville, GA 30360. Members receive *Tipularia* without extra charge. Persons wishing only to receive the magazine may become *Tipularia* associates for \$10 a year. Single copies, when available, may be ordered from Sally Emory, 7575 Rico Rd., Palmetto, GA 30268 (1991 and before, \$4; 1992 and after, \$10).

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Tipularia strives to combine the scientific authority of a botanical journal with the readability of a magazine. Some articles are assigned; unsolicited manuscripts are welcomed for consideration. *Tipularia* is unable to pay for articles or art, but there is no charge for publication of them.

Tipularia

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2 **Vanishing Pitcher Plants: Drawings by Marcia R. Cohen** By Lisa Frank
Sarracenia on the brink

6 **Bog Plant Conservation: The Atlanta Botanical Garden** By Ron Determann
Plant propagation and bog restoration works

10 **Southeastern Pitcher Plant Bogs: A Natural History Sketch**
By George and Debbie Folkerts
Bygone days of bogs stretching from Florida to Mississippi

18 **Tugaloo Mosaic: A Unique Area**
By John Garst and James Sullivan
A chance for important preservation

28 **Doing What Comes Naturally: Marie Mellinger** By Margaret Shannon
A remarkable woman who never quits

9 **Bog Collecting Pressures**
By Henning von Schmeling

17 **Can Pitcher Plants Still be Found?**
By Gail Russell

27 **Biological Diversity** By John Garst

34 **First Person Singular: My Triumph**
By Vivian Emerson

35 **Site-seeing: Whitmore's Bluff**
By Richard Ware

38 **Bookshelf** Book reviews
by Marie B. Mellinger and Scott Ranger

On the cover: *Sarracenia oreophila*

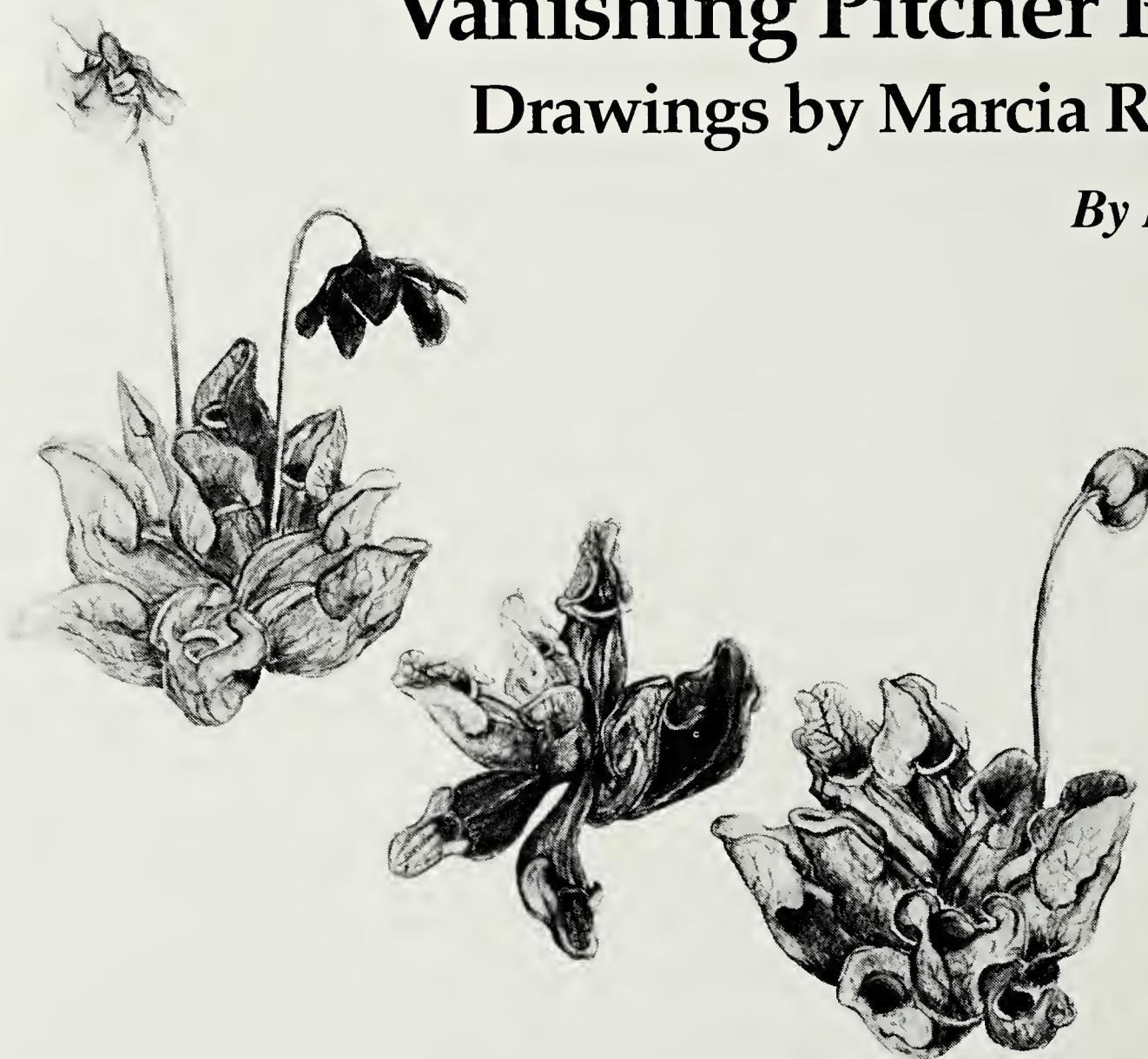
Pastel drawing by Marcia R. Cohen, from
"Portfolio Number One: Genus Sarracenia"

Inside front: Byliners

Inside back: Errata

Vanishing Pitcher Plants: Drawings by Marcia R. Cohen

By Lisa Frank



In a lecture at the Atlanta Botanical Garden, artist Marcia R. Cohen was asked, "Why did you omit the decaying pitchers and dead parts of the plant? Isn't that an equally important part?" Her answer was clear. "To maintain a sense of optimism about these vanishing pitcher plants," Cohen replied. "As the project evolved, I felt like I was at their service. As a tribute, I decided to record them at their freshest. I want these drawings to make a hopeful statement."

Marcia R. Cohen, a professor at the Atlanta College of Art, has created an unforgettable series of pastel drawings highlighting seven members of the genus *Sarracenia* to bring attention to the plight of Georgia's endangered carnivorous plants. The large drawings,

done in two sizes (36" x 25" and 24" x 18"), were exhibited at the Atlanta Botanical Garden from January 21 to February 14, 1993. This series, titled "Portfolio Number One: Genus *Sarracenia*," is the culmination of two-and-a-half years of extensive field research, a longtime fascination with nature and color theory, studying the work of other botanical artists and an apprenticeship with Ron Determann, superintendent of the Fuqua Conservatory at the Atlanta Botanical Garden and a renowned expert on carnivorous plants.

Marcia attributes her work to many influences. The most significant issue in her art is color, with particular relationship to Jewish mysticism. For instance, description of color in the Old

Testament is expressed in comparative terms. Color is defined through meaningful connections and descriptions of plants, animals, gems, fabrics and atmospheric phenomena. That notion has been the catalyst for Marcia's art for the past ten years. She is fascinated with the parallel between the branching form and growth cycles of certain plants and the menorah, a seven-branched candelabrum which is an important Jewish symbol in the temple. Botanists have suggested that the original shape of the menorah may have been inspired by the growing habit of the moriah plant (*Salvia palaestinae*).

Cohen also studied the work of several female, lesser-known botanical artists. Of special interest are the botanical drawings of Marianne North (1830–1890), a remarkable woman who traveled around the world several

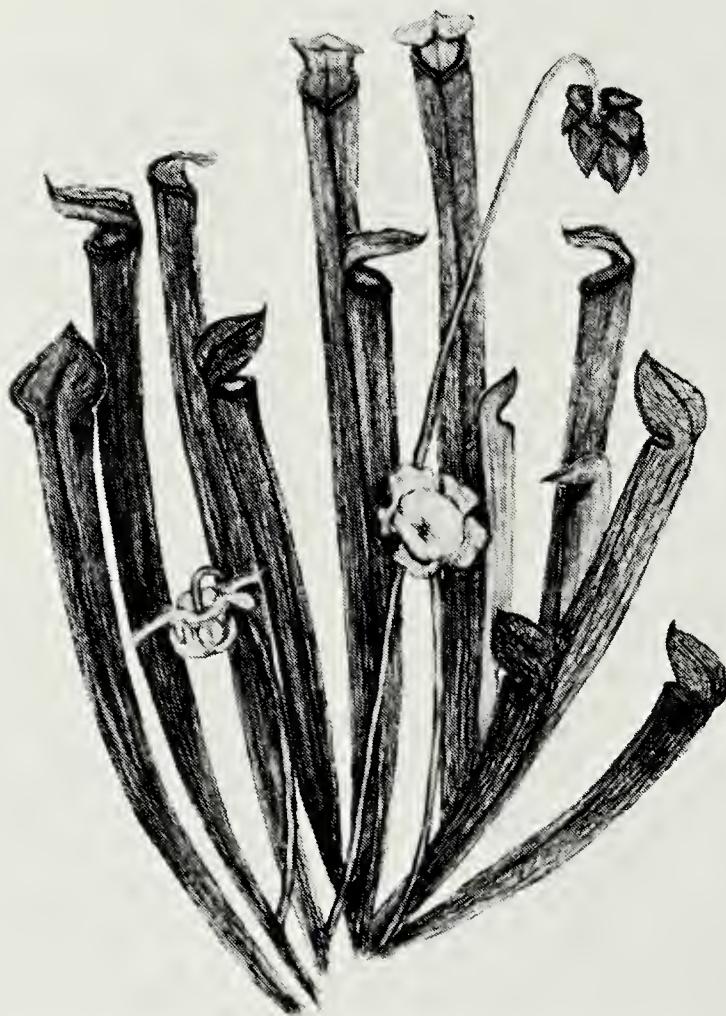
times to very remote places to paint plants. Many of her subjects were unknown to science. In fact, at least four species are named after her, including the carnivorous *Nepenthes northiana*. Today, an entire gallery at The Royal Botanic Gardens, Kew, in London is devoted to her 832 small and vibrant paintings. Ironically, she may not have realized that her work is our only record of a lost botanical world. Even in the first 1882 Official Guide to the North Gallery, the director of Kew warned that plants depicted by Miss North "are doomed shortly to disappear before the axe and the forest fire, and the ever-advancing settler or colonist. Such scenes can never be renewed by nature, nor when once effaced can they be pictured to the mind's eye, except by means of such records as this lady has presented to us."

Marcia Cohen began making her



Photograph: Lisa Frank

Marcia sketches Sarracenia leucophylla in the bog at the Atlanta Botanical Garden. Sarracenia purpurea, opposite page [From the collection of Eleanor W. Lee]



Sarracenia rubra from Portfolio Number One

own plant expeditions throughout the southeast to wetlands and bogs, documenting the region's carnivorous plants including sundews (*Drosera* spp.), butterworts (*Pinguicula* spp.) and Venus' Fly Trap (*Dionaea muscipula*). She also traveled with the Georgia Botanical Society on a Wildflower Pilgrimage to Kolomoki Mounds, to the Florida Panhandle with George Sanko and to North Georgia with Tom Patrick (to view the remaining sites of the green pitcher plant, *Sarracenia oreophila*), all deepening her fascination with Georgia's carnivores.

In 1990, Marcia scheduled a sabbatical from the Atlanta College of Art and was on her way to Israel, specifically to study plants at Neot Kedumim, a nature reserve near Tel Aviv where much of the flora mentioned in the Bible and the Talmud is cultivated. But the Persian Gulf War broke out and she decided to stay in Georgia. She seized the opportunity to

pursue wholeheartedly her drawings of the endangered carnivorous plants she had been studying. (Nine months later, she did go to Israel.)

To subsidize the project, she wrote to several agencies and was awarded three grants. Her ideas were supported by the Georgia Council for the Arts, the City of Atlanta Bureau of Cultural Affairs and the Fulton County Arts Council.

She made several trips to the Okefenokee Swamp, always setting up two tents, one small tent for sleeping and one tall enough to stand and work in. "Have studio, will travel," jokes the energetic 42-year-old. She made hundreds of sketches and photographs in the field, returning to the same sites several times to document seasonal changes. Each drawing represents every stage of development, from bud to flower to mature pitcher.

Perhaps her strongest impetus and source of constant encouragement throughout the project was Ron Determann, who opened her eyes to the urgency of preserving these endangered plants and inspired her to participate in the recovery programs he established for the purple pitcher plant (*Sarracenia purpurea*) and several others. He visited her studio at every critical juncture, verifying the botanical accuracy of the works in progress.

According to Ron, Marcia's contributions are significant. "She has made us look at these plants from a new perspective. Her drawings focus attention on them, which is certainly needed."

“Obviously, I learned much about horticulture,” Marcia notes. “Understanding the unique adaptations these plants employ to lure their prey and closely observing their chromatic changes throughout the seasons were essential for completing the drawings.”

The greatest advantage of a botanical drawing compared to the capacity of one single photograph is that the artist has the opportunity to maximize the transitory nature of the plant, by including all aspects of its life cycle. Each plant was first drawn on tracing paper until it was considered botanically correct, making all revisions at this stage. That image was transferred with graphite carbon paper to a hand-made Canadian pastel paper for the color rendering. To evoke the erotic, often animated, qualities of these special plants, Cohen chose the rich range of hues indicative of Rembrandt pastels. Her technique involved layering and blending these pastels, then applying the fine details of

venation and markings with a variety of colored pencils. Her careful process allowed for the articulation of both the translucent “windows” of the white-topped pitcher plant (*Sarracenia leucophylla*) and the complex patterns of the red venation on many of the others.

Marcia made several formal decisions regarding the format and presentation of these plants. For instance, the drawing of *Sarracenia leucophylla* is the only one that ends abruptly at the bottom edge of the page, symbolizing its total extinction in Georgia. In contrast, the other species are presented in their entirety, yet their isolation on the page implies their vulnerability.

With this project complete, Marcia returns to where she left off. She will continue drawing and painting based on information gathered in Israel. Her interest remains in deepening her understanding of nature, specifically as it pertains to Judaic thought.



Sarracenia flava, one of Marcia's seven pastel drawings to bring attention to the plight of endangered carnivorous plants in Georgia

Photograph: Craig Scogin

Bog Plant Conservation: The Atlanta Botanical Garden

By Ron Determann

An official conservation program was launched at the Atlanta Botanical Garden in July 1990. Although with the opening of the Fuqua Conservatory in 1989 it had been decided that conservation and conservation education would be a major focus, a formal program with our native Southeastern plants had not yet been started. Meetings with various conservation organizations in the state resulted in guidance and communication of the most important priorities. How the Atlanta Botanical Garden could help with expertise and hands-on propagation of species suitable for this form of recovery was also determined. Now that the facilities for propagation in the form of the Cecil B. Day back-up greenhouses were in place, the program could get started.

The first species we tackled was *Sarracenia purpurea*, the purple pitcher plant, specifically the mountain bog form. The condition of this species demonstrates the deplorable shape of many of our mountain bogs. Some rescue material was obtained from one such bog so that artificial propagation of this form could begin. *Sarracenia* lend themselves very well to

greenhouse propagation, and the material was doubled vegetatively within a year.

Simultaneously bog restoration was started. This particular bog was terribly overgrown, and the water table had shifted away from the actual place where the *Sarracenia* were growing. The encroaching vegetation was hacked out and new areas opened up for the restoration of the species. In a matter of months the results could be seen: The *Sarracenia* colored up and transformed from solid green phyllodia barely resembling pitchers to beautiful, heavily-veined purple pitchers. Two-and-a-half years into the program, healthy purple pitcher plants are once again growing in one of our mountain bogs.

The population has now also been augmented with almost 50 plants from vegetative propagation in the greenhouses, thus nearly tripling its size. In addition, during the spring of 1992 about 12 plants flowered in the bog, and some seed was collected that has since germinated. The plants held back in the greenhouses flowered as well, and seed was set on those, cross-pollinating the various clones and

resulting in more seedlings growing in the greenhouses. Other species of conservation interest in this mountain bog community are *Kalmia angustifolia* (sheep laurel) and *Juncus gymnocarpus* (bog rush).

Georgia has a total of three known populations of purple pitcher plants, two of the mountain bog form and one of the distinct Atlantic coastal form *Sarracenia purpurea* ssp. *venosa*. The Atlanta Botanical Garden is working on the recovery and protection of all three populations and currently holds material for safekeeping and further recovery work.

Another species in peril in Georgia is the beautiful *Helonias bullata*, the swamp pink. This federally-listed endangered species, together with our mountain bog purple pitcher plant, reaches its southern limit in the North

Georgia mountains. It has been reduced to growing in only one known location, that being in Rabun County. The bog where it grows seems to be in very sad shape. Not only is it terribly overgrown, but it suffers also from weed encroachment, agricultural chemical and nutrient intrusion, major erosion and the associated intrusion of silt. It is especially unfortunate because this private bog also holds the other population of *Sarracenia purpurea* (the mountain bog form), as well as *Kalmia angustifolia*.

Last year we were lucky enough to obtain some seed of the only *Helonias* that set seed there, which we germinated immediately. This species does not seem to need to be stratified in order to germinate, but the seeds do need light. We now have about 150 seedlings growing in the greenhouses



Photograph: Craig Scogin

***Sarracenia minor*, drawing by Cohen who studied horticulture with Determann**
[From the collection of Dr. C. Tully & Dr. J. Walker]

and hope to do recovery work with this material this year. For this species, since its only known Georgia population is so threatened, we are looking into doing an actual reintroduction onto a protected suitable site.

There is another species of pitcher plant that deserves attention and that is our green pitcher plant, *Sarracenia oreophila* (see front cover). The Blue Ridge form of this species has only one known population in the North Georgia mountains and one population adjacent in North Carolina. The Georgia population of this federally endangered species is on private land and is basically not protected. A number of years ago it was decided to establish a number of off-site populations as part of the recovery effort for the species. Large numbers of plants are needed for this project, so the Atlanta Botanical Garden is currently growing several thousand seedlings from seed collected from the Georgia population. This past year we re-established several hundred seedlings at a new site to safeguard the survival of this species for future generations.

As part of the ongoing recovery programs for pitcher plants in the state of Georgia, an interesting discovery was made last year at the Atlanta Botanical Garden. A large seed lot of *Sarracenia rubra* was grown from a population on private land in Taylor County, Georgia. The seed was collected in the late summer and immediately sown out and stratified. About two months later good germination was observed.

As part of our growing techniques we place the seeds after germination under fluorescent lights on about a 16- to 17-hour day-length growing cycle. This brings out their red anthocyanin pigments and stimulates growth. Soon

it was observed that two of the tiny seedlings lacked all red color, staying bright green. Along with the red seedlings, one of these green seedlings grew up quickly, while the other green seedling quickly succumbed. The surviving green plant was, however, at least as vigorous as its red kin and in flower less than two years after sowing.

One interesting observation that can be made in this anthocyanin-free form of *S. rubra* is what we refer to as "windows" on the back of the pitchers. This suggests that the insects that get trapped in the pitchers probably see windows in the red form as well. We humans cannot detect this feature with the naked eye in the normal red form, but it is clearly visible in some other species, such as *Sarracenia minor*.

The Georgia *Sarracenia rubra* form, for now just referred to as the "fall line form," is known from only a handful of locations in the state. The current nomenclature of the subspecies is not entirely clear. Superficially this subspecies comes close to *Sarracenia rubra* ssp. *gulfensis*. Further genetic studies among the various subspecies and populations is warranted. Georgia holds a widely scattered continuum between populations of *Sarracenia rubra* ssp. *rubra* in the coastal Carolinas and the above-mentioned *S. rubra* ssp. *gulfensis*. It occurs not only in wet nutrient-poor meadows, but also on hillside seepage bogs and along pristine creek banks. It is from one of the creek-dwelling populations that we drew this seedlot. The Atlanta Botanical Garden is currently working on the recovery of four populations of this species in Georgia, including two on Fort Benning.

Bog Collecting Pressures

There is a large market for live and cut pitcher plants, and trade in these endangered species is on the rise. Even though they are protected, many plants are dug in the wild and brought into the market as mature plants. Not only is this often illegal, but many of the purchased plants do not survive because they are not given proper care.

At the Chattahoochee Nature Center near Roswell we are attempting to propagate pitcher plants in large quantities in order to market them as non-collected plants that are healthier and more likely to survive cultivation. Eventually, we would like to supply pitcher plants to other countries such as Germany and Japan, where the carnivorous plant craze has hit an all-time high. Producing large quantities of these plants through tissue culture and distributing them worldwide might relieve the wild populations of the collecting pressures they are now under and allow people to maintain a viable business at the same time.

*by Henning von Schmeling, horticulturist,
Chattahoochee Nature Center, Roswell, Georgia*



Photograph: Craig Scogin

Sarracenia psittacina from the drawings of Marcia R. Cohen, Atlanta College of Art

Southeastern Pitcher Plant Bogs: A Natural History Sketch

By George and Debbie Folkerts

As the Coastal Plain of southeastern North America formed during the recession of the Cenozoic seas, sandy soils of low nutrient content developed from former marine sediments. Some of these soils came to occupy high dry sites, but others were close to the water table or lay on slopes where layers of clay prevented downward percolation of the water. These soils were saturated with water for much of the year. As plants colonized these sites, the ones which were successful were those that could succeed in spite of the wetness and low nutrients. Among the plant types that populated these boggy soils were several groups which, earlier in their history, had developed methods of supplementing their nutrient intake by trapping small animals, mainly insects; in other words they had become carnivorous. Because the largest and most conspicuous of the carnivorous types are the pitcher plants with their showy tubular leaves, these sites are often called pitcher plant bogs. Presently pitcher plant bogs range from southeastern Virginia south to central peninsular Florida and west to east Texas.

In the uplands above the Coastal Plain there are remnant bogs such as

the sites where the green (*Sarracenia oreophila*) and mountain (*Sarracenia rubra* ssp. *jonesii*) pitcher plants occur. Also, coming down the Appalachians from the north are the southernmost bogs of the northern or boreal type. These contain only the purple pitcher plant, *Sarracenia purpurea*. Their carnivorous flora is not as diverse as in bogs of the Coastal Plain.

Today the flora of the pitcher plant bogs in the Southeast includes over twenty species of carnivores. In addition to eight species of pitcher plants belonging to the genus *Sarracenia*, there are sundews (*Drosera* spp.), butterworts (*Pinguicula* spp.), bladderworts (*Utricularia* spp.) and the Venus' flytrap (*Dionaea muscipula*).

The familiar sundews trap insects on shining globules of sticky mucus secreted by hairs on leaves. Digestion is accomplished by enzymes secreted by the ends of the glandular hairs. In a number of species the hairs fold down to form a temporary cavity or "stomach" while digestion takes place. Other than the possibility that the glistening mucus resembles nectar and therefore may entice some insects, sundews have no specific attractant mechanism.

Butterworts have flattened leaves

with tiny mucus-secreting hairs on the surface. They often trap a variety of tiny flies. Here again, the glistening appearance may serve to beguile some insects, but sweet odors and sugary lures are absent.

Most bladderworts in the region are aquatic, but three terrestrial species commonly occur in pitcher plant bogs. Their tiny bladders, when triggered, quickly expand to suck in small prey items. In terrestrial bladderworts, the bladders lie in the saturated soil and are difficult to see. Their trapping efficiency apparently depends on having so many bladders that tiny prey items are likely to stray near to at least a few of them. The bladders seem to have no means of attracting prey.

The Venus' flytrap, often called the world's most phenomenal plant, is a relative of the sundews in which the two halves of the leaf can fold together in about a second to entrap an animal that has stimulated tiny trigger hairs on the internal leaf surfaces. Digestion of the prey occurs as inner surfaces of the leaves liberate digestive substances into the cavity formed by the tightly closed leaf. The often bright reddish color of the leaves may attract insects which visit flowers, but the sweet nectar formed by glands at the leaf edges is probably the main attractant.

In addition to soaked soils and scarce nutrients, the plants which pioneered these boggy places had another challenge to contend with, that of frequent fire. Natural

fires in southeastern North America are the results of lightning strikes that come with the thunderstorms of spring and summer. Fire is a necessary component of most of the natural habitat types of the southeastern Coastal Plain. Even though we are still being assaulted with anti-fire propaganda which makes contentions like, "When the forest burns everyone loses," we must realize that in reality most species benefit from fires. The renewing parts of bog plants—corms, bulbs and rhizomes—all occur beneath the ground, and although fire may destroy the above-ground parts, the portions beneath the soil remain unharmed and soon produce new shoots and leaves above ground. What anti-fire publicity really means is that when the forest burns, timber profits may be reduced because fire damages stands of fire-intolerant trees planted in sites where they would not normally occur.

Over the eons, frequent fires in the bogs made them open habitats populated almost exclusively by perennial herbs. A few annual species



The leaves of the white-topped pitcher plant (S. leucophylla) resemble flowers and attract large numbers of insects.

Photograph: Debbie and George Folkerts

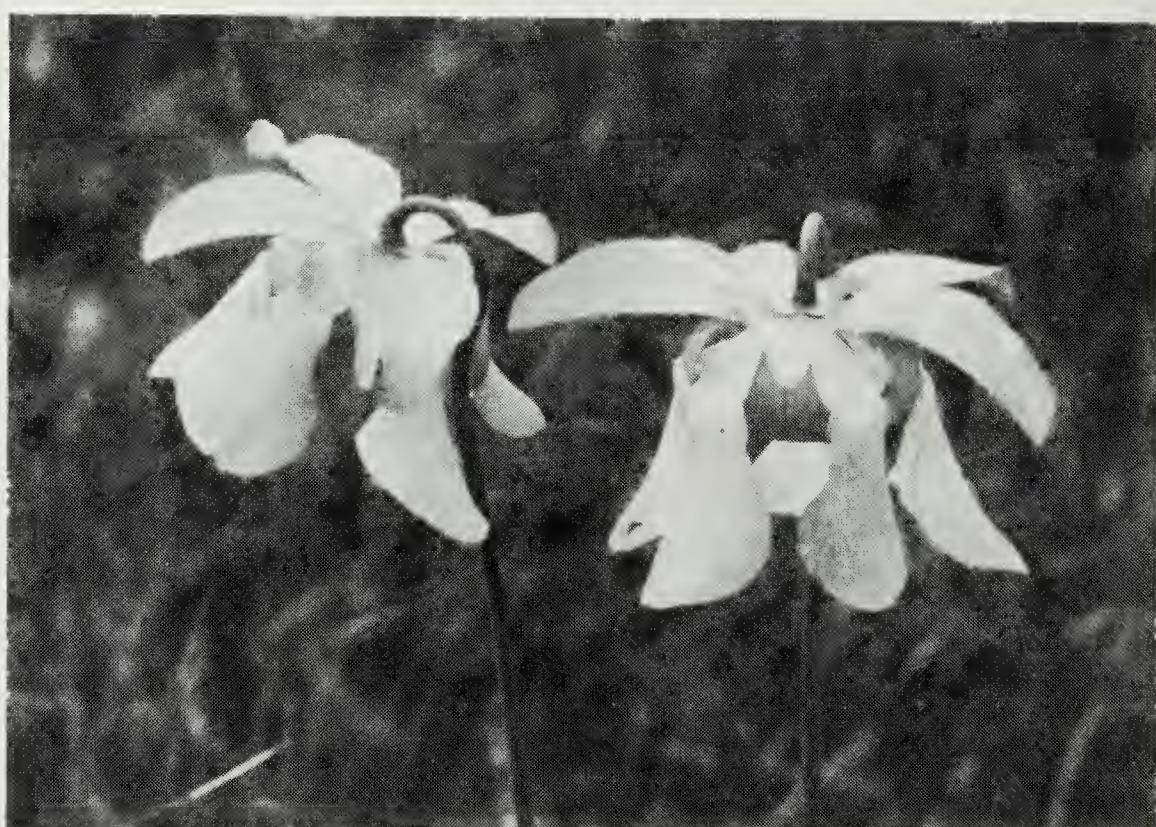
are present, but woody species are usually absent from bogs with a normal fire cycle. Fires during the growing season—the time when fires naturally occur—kill woody invaders and keep the bogs open. Even though wax myrtle (*Myrica cerifera*), sweet bay (*Magnolia virginiana*), gallberry (*Ilex glabra*), bamboo vine (*Smilax laurifolia*) and a variety of other woody types invade if fire is suppressed, these types rarely became abundant under primeval conditions when the spread of fire was unimpeded by roads, ditches, canals and other artifacts of human development.

In the Southeast as a whole, fully 260 species of perennial herbs are characteristic of pitcher plant bogs. If the names of these habitats were to reflect the most abundant group of plants present, they would be called sedge bogs because the sedge family is the most species-rich family with nearly fifty species. Moreover, in the sedge family, the beakrushes of the genus *Rhynchospora* number more than twenty species, so beakrush bogs would also be an appropriate name.

Other plant groups that are well represented include the composites with thirty species, the grasses with around twenty-five, and the lilies with thirteen. Milkworts, yellow-eyed grasses, pipeworts, meadow beauties, and bog gentians are also well represented. Bogs are often thought of as the abodes of orchids,

and a few sites may harbor as many as fifteen species. This is a respectable number even if it does not quite equal the twenty that may occasionally be found in some of the northern bogs.

Although a number of the common bog plants may be found in bogs throughout the southeastern United States, most are more restricted. Among the pitcher plants, none has a geographic range that encompasses the entire area from Virginia to Texas. For example, the winged pitcher plant, *Sarracenia alata*, ranges from southern Alabama west to eastern Texas and is the only *Sarracenia* found west of the Mississippi. *Sarracenia minor*, the hooded pitcher plant, is the only species found in central Florida. The other species are similarly restricted, yet overlap of their ranges is such that in some Gulf Coast bogs, as many as five species of *Sarracenia* may be found together (*S. flava*, *S. leucophylla*, *S. psittacina*, *S. purpurea*, *S. rubra*). The most wide-ranging species is the purple pitcher plant which occurs from eastern Louisiana up the eastern seaboard and throughout much of the



Cream-yellow flowers of the winged pitcher plant

northeastern U.S. and southern Canada. It is therefore the only pitcher plant occurring in both southern and northern bogs. A few other bog plants such as the water sundew (*Drosera intermedia*), and the common grasspink orchid (*Calopogon tuberosus*) have similar ranges.

Carnivorous plants, like carnivorous animals, may compete with one another for the prey available. As a result of a long history of competition, differences have developed among the pitcher plants which allow them to capture somewhat different types of prey. For instance, the trapping leaf of the parrot pitcher plant, *Sarracenia psittacina*, reclines on the ground and has a small opening in its in-rolled hood. The prominent flanges on the leaves direct crawling animals to the opening. Once inside, they are prevented from leaving by extremely long backward-pointing hairs. This pitcher plant has therefore adapted to trap prey that crawls along the ground. In contrast, the pitcher of *Sarracenia leucophylla* has a bright white leaf top which functions as a false flower to lure insects which normally visit flowers. The leaf also produces significant quantities of nectar which add to its attractiveness. Flying insects become its main prey. A third strategy is illustrated by the purple pitcher plant. The hood on the pitchers of this species is upright, allowing the pitchers to fill with water during rains. Prey are entrapped in the small pool within the leaf and eventually drown.

At all times of the year, healthy pitcher plant bogs provide striking floral displays. More so than in many other southeastern habitats, the flowering season is spread throughout the year. The season on the Coastal Plain begins in January when the sunbonnets



Photograph: Debbie and George Folkerts

*August marks the flowering of the two characteristic true lilies, *Lilium catesbaei* and *Lilium iridollae* (above).*

(*Chaptalia tomentosa*) begin to bloom on warm sunny days. They are soon followed by the spring bartonia (*Bartonia verna*), whose diminutive cream flowers are present throughout February and into March. Beginning in late March, the pitcher plants produce their red or yellow flowers. The first to bloom is the purple pitcher plant. The last is usually the hooded pitcher plant, which may bloom into mid-May in North Carolina. The green and mountain pitcher plants of the uplands may bloom even later in some years.

As spring proceeds, the numbers of species flowering increases until fifty species may be in flower on a late June day in some Gulf Coast bogs. In mid-summer, snowy orchids (*Platanthera nivea*), bog gentians (*Sabatia* spp.), and

meadow beauties (*Rhexia* spp.) dot the bogs and savannas. August marks the flowering of the two characteristic true lilies, *Lilium catesbaei* and *Lilium iridollae*. As fall approaches, the members of the sunflower family become conspicuous. Fall is characterized by masses of rayless goldenrods (*Bigelowia nudata*), among which are sprinkled blazing stars (*Liatris* spp.) and narrow-leaved sunflowers (*Helianthus angustifolius*). In late November and even into December a few shortleaf lobelias (*Lobelia brevifolia*) add purple highlights.

Although the plants are the most conspicuous feature of the bogs, a great many animal species are also typical inhabitants. Because these areas are open, they provide little cover for large animals such as bear and deer. Most of the animal denizens are therefore small in size. The largest animal that frequents pitcher plant habitats is the sandhill crane, one of the tallest North American birds. Cranes may visit bogs during migration, but a Gulf Coast population, called the Mississippi sandhill crane, is a permanent resident of coastal savannas that contain many pitcher plants. Several years ago a pair nested in a pitcher plant bog in southern Mississippi. Nests, made on the ground, are of mud, grasses and other vegetation. Insects and other small animals are the major foods, although cranes also eat some seeds and fruits.

Crayfish are conspicuous in many bogs because of the products of their work. A number of species of burrowing crayfish live in tunnels which they construct in bog soils. Their burrowing and earth-moving activities result in the accumulation of piles of soil above the openings to their

excavations. Thus, areas of bare soil are created which may serve as sites for seed germination and seedling survival for the bog plants. Additionally, the bringing of soil up into the air may allow the decay of organic materials and the release of nutrients vital for plant growth.

Although the major relationship of insects to carnivorous plants is in their fate as prey, insects interact with pitcher plants in many other ways. All pitcher plants are pollinated by bees, the larger-flowered ones by bumble bees and the smaller-flowered ones by a variety of smaller bees. In pitcher plant flowers the pollen and nectar, the rewards for pollinators, are enclosed in a chamber formed by the hanging petals and a peculiar upside down umbrella-like structure which is a portion of the female flower parts. This unique structure must be correctly manipulated by insect visitors in order to obtain access to the rewards inside. The bee must either push back one of the lobes of the umbrella or somehow pull a petal out while crawling around behind it. Forcing the visiting insect to take a certain path insures that the pitcher plant benefits from cross-pollination rather than being self-pollinated most of the time. Watching pollinators learn and become proficient at entering and leaving pitcher plant flowers can be fascinating.

A number of insects and related types have circumvented the trapping ability of the pitcher plants and live inside the pitchers for part or all of their lives. These include a non-biting mosquito whose larvae inhabit the water in purple pitcher plant leaves, three moths whose caterpillars feed inside the leaves, at least seven fly species whose maggots develop among



A pine woods treefrog is poised on a yellow pitcher plant, ready to capture incoming insects or merely to use the plant as refuge.

the decaying prey, and ten or so other assorted species.

In the case of the large flies whose maggots inhabit the prey mass, the adult female flies cannot risk being trapped and so must drop their tiny larvae into the pitchers by gingerly hanging the end of their abdomen over the edge of the pitcher. The larvae crawl out of the pitchers and change into adults in chambers in the bog soil.

The pitcher plant moths have a host of adaptations which allow them to exploit the pitchers successfully. The caterpillars spin a scaffolding of webbing which prevents them from being entrapped. They feed only on the inner lining of the leaf, leaving the outer lining as protection and causing the top of the leaf to topple over,

effectively preventing entrance by prey or small predators. The change to adult form takes place within the pitcher. The adult crawls out to search for fresh pitchers in which to mate and/or lay eggs. Adult pitcher plant moths have feet with an unusual structure, enabling them to crawl about on the inside walls of the pitchers.

A number of others are frequent or occasional inhabitants of pitchers but also live elsewhere. Spiders often lie in wait inside the pitcher mouth, sometimes managing to steal the prey attracted by the pitcher. Even treefrogs may be found resting within the humid confines of a pitcher. Spiders are rarely entrapped because their silken draglines allow them to climb out of most cavities. The adhesive toe pads of treefrogs usually allow them to climb out of pitchers that they may enter.

Many of the insects and other animals of pitcher plant bogs, notably those associated with pitcher plants, occur nowhere else in nature. All are as unique and deserving of protection as are the plants. Unfortunately, the "the only good bug is a dead bug" fallacy that most humans still cling to tends to make us think that insects, especially those which chew on plant parts, are best exterminated. Just as predators are vital to the health and survival of prey, herbivores may be important to the plants on which they feed.

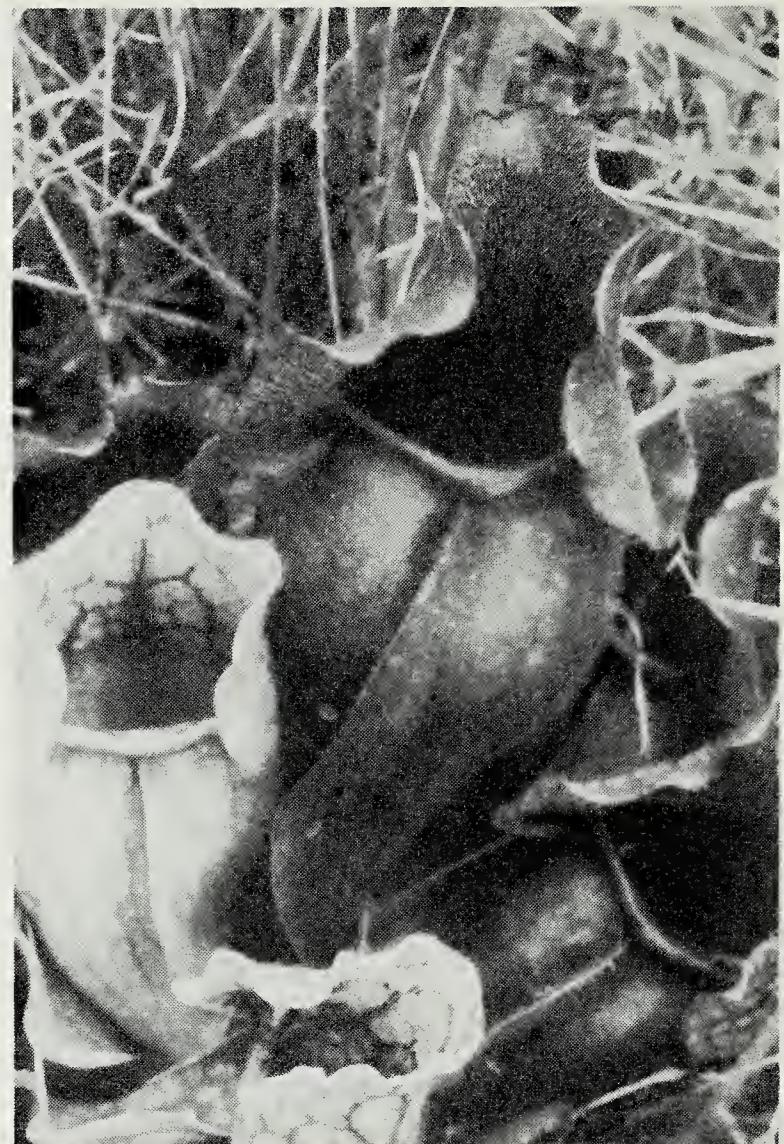
In the 1700s, when William Bartram traveled across the Gulf Coast, it would have been possible for him to ride from the vicinity of Milton, Florida west to Biloxi, Mississippi and be in sight of pitcher plant bogs for most of the time. Only the swamps and marshes associated with Mobile Bay and the Pascagoula River would have formed major interruptions. Similar expanses

of striking beauty would have occurred on the Atlantic Coastal Plain. Today, only a small fraction, perhaps three percent, of the original acreage remains.

The major reasons for the disappearance and degradation of pitcher plant habitats in the southeastern United States are associated with changes in forestry practices that have come about during the last three decades. Clearcutting, drainage, bedding before planting and the establishment of pine monocultures are all inimical to the health of most natural habitats. Fire restriction adds to the damage in many areas. Because of a demand for paper—not an actual need—we are in effect throwing our natural habitats into the wastebasket along with the excess packaging, junk mail, computer printouts and other prodigal superfluities of paper use.

Adding to the damage done by forest practices are conversion of sites to row crop agriculture and pasture, construction of farm ponds, urban sprawl and development, overharvest of plants and plant parts by commercial interests, off-road-vehicle use and a host of other factors. If the present rate of loss continues, there will be few carnivorous plant bogs left by the year 2025.

If you visit the bogs, walk softly and never take the same trail twice. Rutting and soil compaction from human foot traffic are taking their toll at many sites. Resist the urge to dig plants for your yard, garden, or pot. For maximum enjoyment, make your sojourns at different times of the year. Pitcher plant bogs are always beautiful but they are never the same. Try to appreciate all life that is present. There is nothing about a lily that makes it inherently



*The jug-like pitchers of *S. purpurea* hold enough water to trap and drown prey.*

more precious than a maggot—only ignorance or a twisted point of view.

In these days when the natural world is disappearing rapidly, and when jobs and economies are being debated by the captains of industry and the lords of politics, it is vital that we keep in mind that man's relationship with the land is mainly not an economic one but rather a biological one. Pitcher plant bogs and the other natural habitats of the earth are not merely interesting esoterica. They are not parks that we have fashioned or charming gardens like those surrounding some ante-bellum home. They are the fabric and sinew of the world. Processes at work in these places of nature are the phenomena which keep us alive. Preserving them is no luxury but is an absolute necessity if we are to have a future.

Can Pitcher Plants Still be Found?

by Gail Russell

As a complement to the articles on pitcher plant bogs, we wanted to highlight some locations in Georgia where one could go to see them; however that was a difficult job. The Chattahoochee Nature Center near Roswell and the Atlanta Botanical Garden both feature pitcher plant exhibits. In the wild, however, pitcher plant bog habitats are disappearing and, as a result, good viewing locations are becoming extremely hard to find.

Perhaps the best public location is the Reed Bingham State Park located near Moultrie. There a nature trail leads through a bog and offers a close-up view of many plants in their natural habitat. Pitcher plants may also be seen in wetlands and roadside ditches in the Okefenokee National Wildlife Refuge.

While these locations present some opportunities for the public to view pitcher plants, it must be emphasized that they represent only marginal habitats characterized by very small populations of plants. Small populations may also be found on private lands. Many of us have enjoyed the pitcher plants on Tommy and Ann Barber's property, which they have so generously made available to the Georgia Botanical Society for field trips. It has, however, become very difficult to find large fields of pitcher plants as were common in the past.

My search for natural stands of pitcher plants made me aware that there is an urgent need for the acquisition and active management, including prescribed burning, of pitcher plant bog habitats. Fortunately, both the Georgia Department of Natural Resources under Gov. Zell Miller's Preservation 2000 initiative and the Georgia office of The Nature Conservancy have acquisition and management plans on their books. Seepage bogs can be found at The Nature Conservancy's newly acquired Broxton Rocks Preserve (access is by permission of The Nature Conservancy).

Also, the Atlanta Botanical Garden, the DNR's Natural Heritage Inventory program and The Nature Conservancy are together discussing plans to coordinate the management of pitcher plant bogs on private lands. Assistance such as supervising prescribed burning and restoring hydrologic conditions would be provided to private land-owners to help them preserve their bog habitats. These efforts need support. Also needed is an increase in public awareness concerning bog preservation. It would indeed be sad for us all, and especially for our state, to lose these marvelous and interesting plant communities.

Ron Determann of the Atlanta Botanical Garden, Jonathan Streich of The Nature Conservancy and Tom Patrick of the Georgia Department of Natural Resources, Game and Fish Division, Natural Heritage Inventory program were consulted for information provided here.

Tugaloo Mosaic: A Unique Area

By John Garst and James Sullivan

In northeast Georgia and adjacent South Carolina, there is a remarkable area containing a dazzling diversity of plant life, including many rare, endangered, scarce, threatened, peripheral, and disjunct species. It is a dense mosaic of diverse habitats with soils derived from folded and broken layers of a variety of metamorphic and igneous rocks. We propose that it be called the Tugaloo Mosaic, recognizing that its heart lies in the drainage basin of the Tugaloo River.

Although many specific localities within the Tugaloo Mosaic have been recognized for their unusual botany, the region has not been considered previously as an integral unit. We see it as a unique network of communities. It is a precious reservoir of biological diversity that should be protected.

Definition and Location

The Tugaloo Mosaic is the intersection of the Gainesville Ridges physiographic district with the Savannah River drainage basin. The Gainesville Ridges, a narrow series of ridges and valleys parallel to the Brevard Fault on both sides (Wharton, 1977; Hodler, 1986), crosses Georgia from southwest to northeast, through

Atlanta and Gainesville. Most of the Gainesville Ridges drains into the Chattahoochee River, which flows southwest to the Gulf of Mexico, but in Habersham County the Gainesville Ridges is crossed by a divide, east of which the drainage is into the Savannah River and the Atlantic Ocean.

The inset map shows the location and extent of the Tugaloo Mosaic in Georgia. The larger map shows some of its major features. From Tallulah Gorge south, the boundaries of the Tugaloo Mosaic in Georgia are nearly coincident with those of the Chattahoochee National Forest. The southeastern boundary is also nearly coincident with Georgia Highway 184.

Geology

The density of habitats and diversity of plant life in the Tugaloo Mosaic is a consequence of its geologic, climatologic, hydrologic, and biologic history. The Appalachian region has a complex geologic history (Wicander, 1989). About 500 million years ago, mountain building began, and it continued in episodes that span about 300 million years. As the continental plates of North America and Africa moved back and forth, parts of the

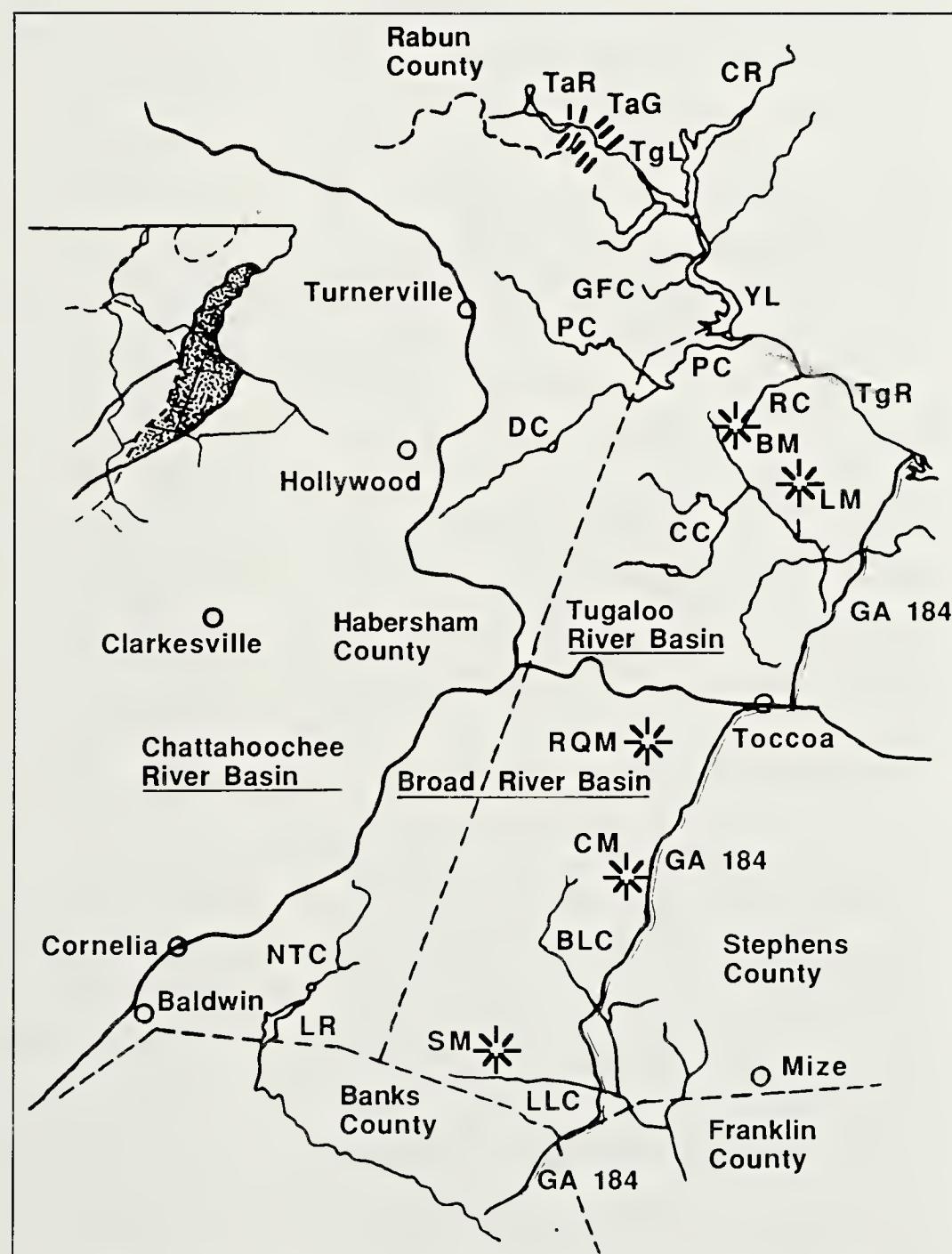
region were sometimes submerged under the sea and sometimes uplifted, and the ocean floor and islands were shoved up onto a stable interior, the craton. Strata folded, buckled, and melted, producing volcanic activity and metamorphism. Weathering occurred constantly, and hydrologic and biologic as well as climatologic forces molded the landscape. The Brevard Fault and Gainesville Ridges are consequences of these activities.

Most geologists identify the Brevard Fault as the interface between the Blue Ridge and the Piedmont (Hack, 1982). Thus, the Gainesville Ridges, and therefore the Tugaloo Mosaic, is part Blue Ridge, part Brevard Fault, and part Piedmont.

As a direct consequence of its interfacial location, the landscapes of the Tugaloo Mosaic have been molded by special hydrologic forces. There is strong evidence that the Chattooga River was, long ago, the upper part of the Chattahoochee River (Johnson, 1907). By erosion, the headwaters of streams move upstream. In this way the Tugaloo River, long ago rising somewhere in the Piedmont, ate its way into the edge of the Blue Ridge, intersected

the Chattooga-Chattahoochee River, and captured its upper branches (now the Chattooga and Tallulah Rivers), diverting them into the Savannah River and cutting off the Chattahoochee to form a separate river.

Tallulah Gorge was cut by the upstream progression of Tallulah Falls, which cut into dense, erosion-resistant quartzite, a process that would be



LEGEND. **Inset:** Stippled area-Tugaloo Mosaic, dashed lines-major river basin divides, light solid lines-county boundaries, heavy solid lines-boundaries of the Gainesville Ridges. **Sites in the Tugaloo Mosaic:** TaR-Tallulah River, CR-Chattooga River, TaG-Tallulah Gorge, TgL-Tugaloo Lake, GFC-“Glade Fern Creek”, YL-Yonah Lake, PC-Panther Creek, TgR-Tugaloo River, BM-Black Mountain, DC-Davidson Creek, LM-Lee Mountain, CC-Cedar Creek, RQM-Rock Quarry Mountain, CM-Currahee Mountain, NTC-Nancy Town Creek, BLC-Big Leatherwood Creek, LR-Lake Russell, SM-Soapstone Mountain, LLC-Little Leatherwood Creek.

continuing today if the river were still flowing over the falls (it was dammed at the head of the falls in the early twentieth century). On the Chattooga River, the rocks are a mica schist that is less resistant to erosion. Erosion and weathering have already levelled the course of the river, eliminating the falls that are believed to have been present earlier. On smaller scales, downcutting occurred at many other places in the Tugaloo Mosaic, producing waterfalls and deep ravines, gorges, and canyons, such as those on Davidson, Panther, and Cedar Creeks.

Sedimentation, volcanic activity, and metamorphism produced strata of a variety of rocks. Folding, buckling, and weathering exposed these strata at the surface and produced a mosaic of soils. Downcutting by streams flowing from the Blue Ridge to the Piedmont also exposed different strata in the resulting ravines, gorges, and canyons. These features play a very important role in supporting plant diversity in the Tugaloo Mosaic.

For example, dolomitic limestone crops out as marble on Davidson and Panther Creeks and at other places along the Brevard Fault, producing circumneutral calcium-rich soils for which certain plants (calciphiles) have strong preferences. Otherwise, limestone is not found in this region. In much of northeast Georgia, the soils contain less calcium and are more acidic.

Other rocks of the Tugaloo Mosaic are mafic (rich in magnesium and iron, as well as calcium) and may be preferred by some plants. Ultramafic rocks contain even more magnesium and iron but are markedly deficient in calcium, and the soils derived from these rocks support a distinctive

vegetation (Dann, 1988; Roberts, 1992). Ultramafic rocks are occasionally exposed in the Tugaloo Mosaic, but their mapping is very incomplete and the accompanying plant communities have not been detailed.

Because different plants are adapted to different soils and conditions, the Tugaloo Mosaic provides possible homes for a wide variety of species. However, they would not be there had they never arrived. Many of them got to the Tugaloo Mosaic when shifting south or north in response to climatic changes.

The ice ages provided the cooling temperatures that drove northern species south as glaciers dipped into the northern states (Pielou, 1991). Southern species tolerated the cooler temperatures, shifted south or survived in refugia (hospitable niches such as canyons and river bottoms with southern exposures). When temperatures rose again, southern species emerged from their refugia and repopulated the area. Northern species, unable to tolerate the increasing temperatures as well as their competitors, died out or shifted north, except where they found refugia (high altitudes, north-facing mountain slopes and river bluffs, gorges, canyons, and ravines with northern exposures).

The Tugaloo Mosaic is rich in sites offering refuge to a variety of northern and southern plants.

Botanical Diversity

The ravines, canyons and gorges of the Tugaloo Mosaic provide much of its botanical diversity. In a brief survey, we begin in the Tugaloo River basin, with Tallulah Gorge, and move south and west.

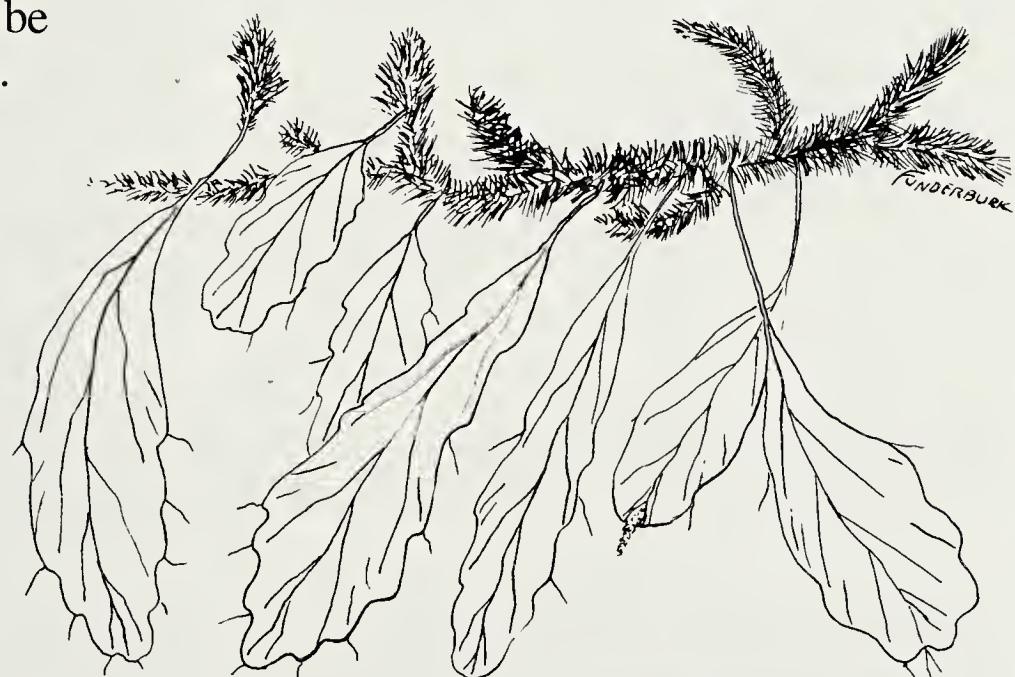
Tallulah Gorge is the northernmost site for Edna's trillium (*Trillium*

persistens, persistent trillium), a Tugaloo Mosaic endemic and federal endangered species. [See Garst's Byliner, inside cover.] It is also home for the monkey-face orchid (*Platanthera integrilabia*), an object of considerable recent interest among Botanical Society members. In Tallulah Gorge, poison sumac (*Toxicodendron vernix*, which is scarce in the Piedmont and Blue Ridge but more abundant in the Coastal Plain of Georgia and in northern states) and bamboo smilax (*Smilax laurifolia*) can be regarded as southern elements.

The ravines of several creeks that flow into Tugaloo and Yonah Lakes harbor Edna's trillium. Another, "Glade Fern Creek," an unnamed tributary of Yonah Lake, contains a large population of glade fern (*Homalosorus pycnocarpos*), which is scarce in Georgia, along with many other northern species.

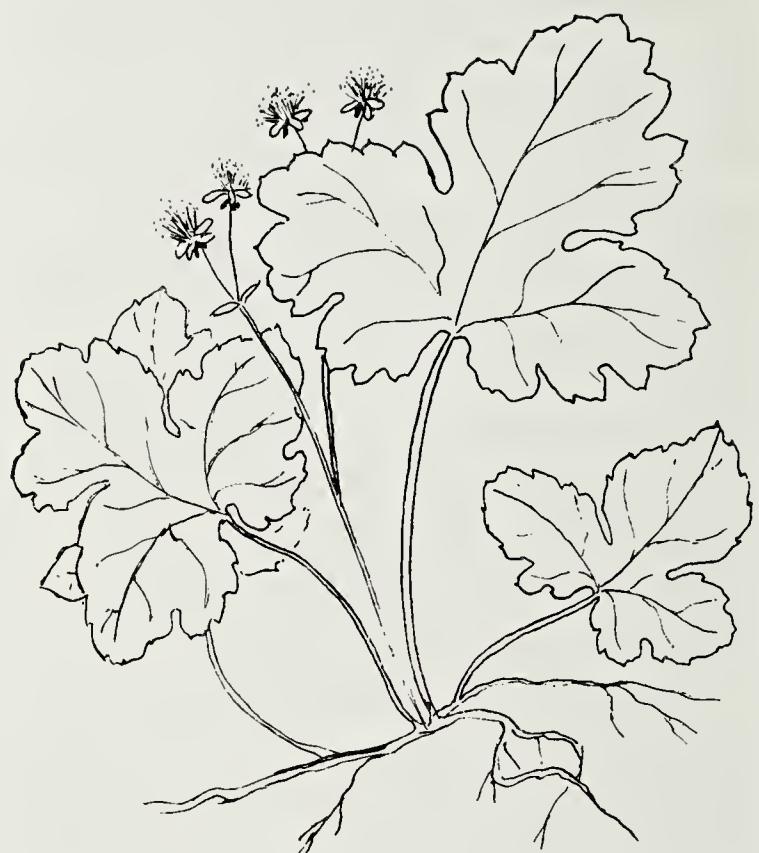
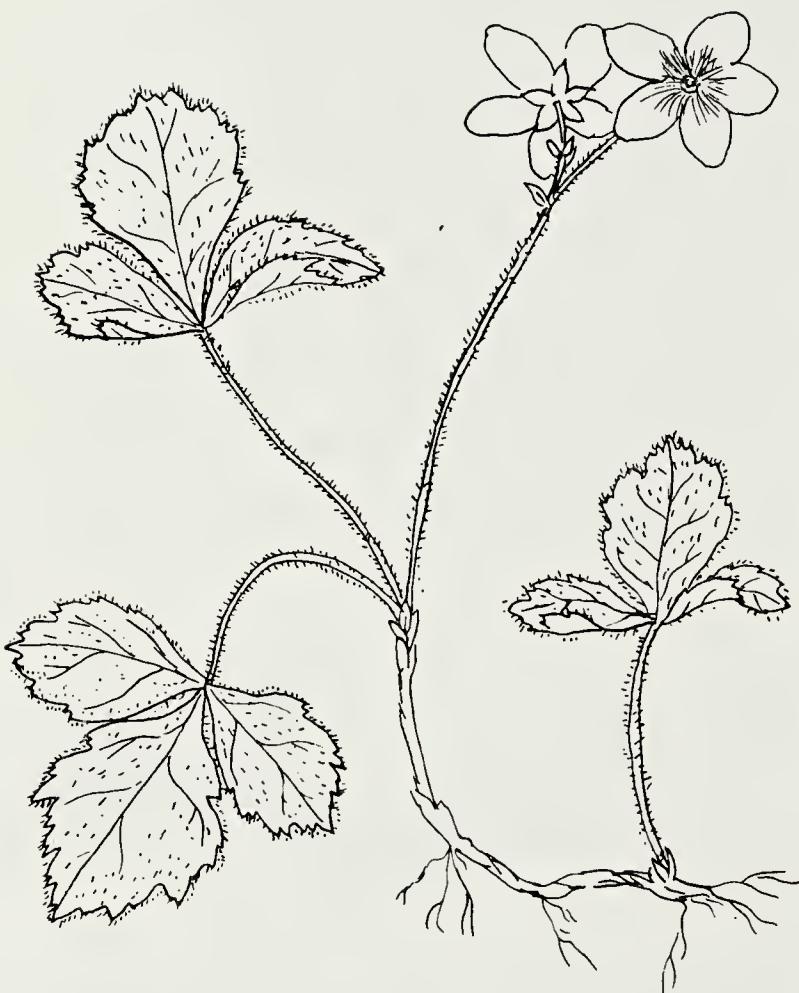
Panther Creek is most amazing. The staggering diversity of plants along this creek between U.S. 441 and its mouth is almost unbelievable. The rare tree yellowwood (*Cladrastis kentukea*) grows here. So do six species of trillium, two of which are rare: *T. persistens* (endangered), *T. discolor* (rare and diminishing), *T. rugelii* (in unusual forms in marble areas), *T. catesbeiae*, *T. cuneatum* and *T. vaseyi*. Of the nine species of native stemmed violets listed by Wofford (1989), eight grow on Panther Creek, including the American dog violet (*V. conspersa*), which is rare in Georgia; only the long-spurred violet (*Viola rostrata*) is absent.

There is also green violet (*Hybanthus concolor*). In the spring, there are dazzling displays of gay wings (*Polygala paucifolia*), another northern species that is infrequent in Georgia and that reaches its southern limits along the Brevard Fault. Similarly, bishop's cap (*Mitella diphylla*), Canada waterleaf (*Hydrophyllum canadense*) and the large purple phacelia (*Phacelia bipinnatifida*), which are all at home in the Great Smokies, grow here in



Peters' filmy fern

disjunct populations. Panther Creek has many orchids, including pink and yellow lady's slippers (*Cypripedium acaule* and *C. calceolus*), spring coral root (*Corallorrhiza wisteriana*), large whorled pogonia (*Isotria verticillata*) and three birds orchid (*Triphora trianthophora*). It has ginseng (*Panax quinquefolius*) and bay starvine (*Schisandra glabra*). And it has numerous uncommon ferns, including glade fern; Goldie's fern (*Dryopteris goldiana*); walking fern (*Asplenium rhizophyllum*), a calciphile; Peters' filmy fern (*Trichomanes petersii*), a dwarf fern that grows here in large sheets at several locations; Alabama lip fern (*Cheilanthes alabamensis*) and



*Abundant in the northern Tugaloo Mosaic, the rare lobed barren strawberry, *Waldsteinia lobata* (right), is compared to the more common *W. fragarioides* (left).*

blackstem spleenwort (*Asplenium resiliens*), which is otherwise found in Georgia in the limestone areas of the northwest and the Coastal Plain.

Davidson Creek, a tributary of Panther Creek, also flows over strata of various rocks, including marble. It harbors Clinton's lily (*Clintonia umbellulata*), yellow mandarin (*Disporum lanuginosum*), fly poison (*Amianthium muscaetoxicum*), American dog violet, green violet and bishop's cap, as well as pink and yellow lady's slippers.

Rothwell (Walker) Creek features *Trillium discolor* and several orchids, including lily-leaved twayblade (*Liparis lilifolia*), puttyroot (*Aplectrum hyemale*) and yellow lady's slipper. In Cedar Creek Canyon, southern maidenhair fern (*Adiantum capillus-veneris*) occurs far north of its usual

range. This is also another haven for Peters' filmy fern, walking fern and lily-leaved twayblade.

In the basin of the Middle Fork Broad River, west of Toccoa, is a site for the unusual shrub, *Nestronia umbellula*. Also, in the basin of the Middle Fork Broad River, Little Leatherwood Creek features the scarce shrub leatherwood (*Dirca palustris*), as well as grass-of-Parnassus (*Parnassia asarifolia*), lily-leaved twayblade, and several other orchids. Nancy Town Creek and Lake Russell have the pink lady's slipper and other treasures.

In many places in the Tugaloo Mosaic, including most of those mentioned above, the beautiful purple stoneroot (*Collinsonia verticillata*) is abundant. The rare lobed barren strawberry (*Waldsteinia lobata*) is common in the Tugaloo River basin.

The diversity of the Tugaloo Mosaic is not limited to the moist areas of the ravines, canyons, and gorges. Indeed, Table Mountain pine (*Pinus pungens*), an Appalachian Mountain endemic, reaches its southern limit here on the dry ridgetops. On the rim of Tallulah Gorge, also at its southern limit, is Carolina hemlock (*Tsuga caroliniana*). Also on the rim is the American climbing fern (*Lygodium palmatum*). From the rim woods there are historic records of the elusive sweet pinesap (*Monotropa odorata*) and turkey-beard (*Xerophyllum asphodeloides*). They should be sought.

The smooth purple coneflower (*Echinacea laevigata*), which was recently federally listed as endangered, grows in exposed dry spots on the slopes of Lee, Rock Quarry and Currahee Mountains. It may prefer soils over mafic rocks. It is found on Currahee Mountain near curlyheads (*Clematis ochroleuca*), an ultramafic associate elsewhere.



Trillium discolor



Smooth purple coneflower

There are sphagnum bogs containing the monkey-face orchid on the slopes of Lee Mountain and Tallulah Gorge. On Lee Mountain and elsewhere in the Tugaloo Mosaic, there are sizable rock outcrops, some of which bear typical Piedmont granite outcrop vegetation.

Imposing the pattern of wet or dry on the pattern of slope steepness and aspect, and that on the finely divided, chemically diverse soils and bedrock creates a very diverse flora. Many of the plants mentioned above are habitat specialists. For example, a road bank on Currahee Mountain provides a relatively dry spot, on a steep slope, with sparse trees and frequently exposed mafic soils in which grow smooth purple coneflowers. This is a very specific habitat! We can only guess what the habitats of this species were like originally.

Need for Botanical Inventory

The Tugaloo Mosaic in Georgia needs a better botanical inventory. The selection of interesting plants given above is an incomplete record of what is found there. A great deal remains to be explored, especially the Broad River basin (including the Lake Russell Wildlife Management Area) and the area east and north of Tallulah Gorge. Even the names on the map suggest that further rare, unusual and diverse plants will be found. In addition to Big and Little Leatherwood Creeks, there is Soapstone Mountain. Although "soapstone" may be used loosely, it usually refers to impure talc. It is a soft ultramafic rock that is frequently associated with serpentine (Dann, 1988). If it occurs on Soapstone Mountain, then a distinctive flora is to be expected there.

Need for Protection and Preservation

The Tugaloo Mosaic should be recognized by federal, state and local governments as an integral area of great botanical significance and value. Agencies that manage the land should protect and preserve the plant communities in the Tugaloo Mosaic. They should promote the restoration of native vegetation as much as possible, allowing maturity to old-growth conditions or fire-maintained communities, as appropriate.

The presence of rare plants in dry habitats and bogs in unusual places exposes a critical weakness of any approach to management that focuses only on the "rich" moist areas of the ravines, canyons, and gorges. Such a focus would withhold protection from dry or unusual areas that are responsible for part of the biological

diversity of the Tugaloo Mosaic. In addition, the close proximities of the densely-packed diverse habitats makes it likely that they are ecologically interdependent, so that a failure to protect some areas could have adverse effects on those nearby that are chosen for protection. The only effective approach is to protect the entire area.

The U.S. Forest Service and Georgia Power Company manage about half of the Tugaloo Mosaic in Georgia. Two large blocks of Chattahoochee National Forest land anchor the two ends of the Tugaloo Mosaic. The northeastern block is the Tugaloo River basin, which includes Tallulah Gorge and Black and Lee Mountains. The southwestern block is the Broad River basin, which includes Currahee Mountain and the headwaters of the North and Middle Forks Broad River. The Georgia Power Company owns Tallulah Gorge and significant parts of the ravines of the tributary creeks of the Tallulah, Chattooga, and Tugaloo Rivers. The State of Georgia has recently entered into an agreement with the Georgia Power Company for the joint management of Tallulah Gorge.

Much of the public land in the Tugaloo Mosaic has been managed for timber production and other purposes that are often detrimental to the unique habitats and plant diversity. For example, Table Mountain pine has been largely extirpated here by fire suppression, stand conversion to loblolly pine, and past timber and agricultural practices. The intensity of timber management in the Tugaloo Mosaic in recent years approaches the limits of sustainability. Seventy to ninety percent of timber harvests in the Chattooga Ranger District occur on this thirty percent of the district. The quality

of aquatic environments is severely impacted by a system of poorly designed and maintained roads.

The density of the road system precludes any chance for wilderness areas and very little acreage is classified as unsuitable for timber production. Under these circumstances, there is little potential for old growth conditions to develop in the National Forest, or on the rapidly developing private lands of the Tugaloo Mosaic.

The National Forest lands in the Tugaloo Mosaic receive intense recreational use from both local residents and tourists. These lands are interspersed with a rapidly developing residential and agricultural landscape that is maintained in nearly perpetual early successional environments.

All along the Gainesville Ridges (and on nearby lands) southwest of the Tugaloo Mosaic, in the Chattahoochee River basin, there are botanical sites with unusual and diverse species. The Tugaloo Mosaic contains exceptional diversity, but the remainder of the Gainesville Ridges is also valuable. However, the only large tracts of public land in the entire Gainesville Ridges in Georgia are in the Tugaloo Mosaic. There is no other opportunity to restore natural forest and aquatic environments in the Gainesville Ridges in Georgia on such a large scale.

A Management Plan

The first priorities in a management of the Tugaloo Mosaic are protection of the unique botanical and habitat

resources and the restoration of forest and aquatic environments. It would be best to terminate all timber harvesting in the Tugaloo Mosaic, pending further study of the area. At the very least, several large tracts should be set aside immediately for protection of unique habitats—such as the Tugaloo River basin from Tallulah Gorge south, including the tributaries of Tugaloo and Yonah Lakes; Panther, Davidson, Rothwell and Cedar Creeks; Black and Lee Mountains; and all of the associated terrain. Another tract is Currahee Mountain and its associated ridges and slopes. Within these areas, forest environments with a natural composition of species should be protected to achieve old growth structure and dynamics on their own. A timber

program would be involved to restore those areas converted by past timber management and agriculture to more natural conditions.

There should be competent inventories of all unique and sensitive botanical sites on National Forest lands in the Tugaloo Mosaic. Protection from all impacts, originating on or off the site, should be ensured.

If a timber program continues on the remaining suitable land, uneven-age methods that maintain some structural identity with old growth conditions should be used. The objective should be to maintain late successional and old growth characteristics.

The headwater areas of the North Fork and Middle Fork Broad Rivers should be managed for watershed

restoration. Headwaters of other rivers originating in the upper Piedmont are already heavily developed, and the opportunity to restore these public watersheds to natural quality with a complement of native aquatic species must not be overlooked.

The Georgia Power Company and the State of Georgia should see that Tallulah Gorge is managed for the protection of its biodiversity. Any construction, even on the rim above the gorge itself, is a potential threat. For example, the recent construction of U.S. Highway 441 at the rim of the gorge resulted in mudslides into the gorge that destroyed several dozen individuals of *Trillium persistens*, including one "permanent" study plot.

It is hoped that the Georgia Power Company will also manage their properties on Tugaloo and Yonah Lakes with the protection of biodiversity as a key element. The company has expressed and demonstrated its commitment to the protection of *Trillium persistens* there. There is no present development on Tugaloo Lake, and it is hoped that there will be none in the future. About 50 lots have been leased on Yonah Lake, which receives moderate to heavy recreational use. On the Georgia side of the lake, the area surrounding Moccasin Creek is especially sensitive for its populations of *Trillium persistens*. A little further south, the ravine of Glade Fern Creek is a rich, sensitive area.

The Tugaloo Mosaic is unique and valuable, and much of it is ours (public land). We must work to protect it.

Botanical illustrations by Mozelle Funderburk

Sources of Species Citations

Plant species mentioned here are from (a) lists provided by Wilbur Duncan: one from a University of Georgia class ("Botany Foray," May 15, 1965, Cedar and Panther Creeks), and one by G. W. McDowell ("Plants Collected by G. W. McDowell and/or F. D. Snyder," April 3, 1961, Cedar, Davidson and Panther Creeks); (b) information provided by Tom Patrick, and (c) personal observations of the authors.

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Biological Diversity

In *The Diversity of Life* (Harvard: Cambridge, 1992), E. O. Wilson argues that nothing is more important for the future of mankind than maintaining biological diversity. Every loss of a species, variety or unusual population diminishes the probability that life as we know or want it will continue. It also diminishes the natural library of genetic information. Each bit of this information is a miracle of survival honed by variation and selection over several billion years. The genetic library contains many secrets whose elucidation could be beneficial. We have “read” only a tiny, virtually insignificant part of it, but even that tiny part has already helped us enormously.

It is fashionable in some quarters to wave aside the small and obscure, the bugs and weeds, forgetting that an obscure moth from Latin America saved Australia’s pasture-land from overgrowth by cactus, that the rosy periwinkle provided the cure for Hodgkin’s disease and childhood lymphocytic leukemia, that the bark of the Pacific yew offers hope for victims of ovarian and breast cancer, that a chemical from the saliva of leeches dissolves blood clots during surgery, and so on down a roster already grown long and illustrious despite the limited research addressed to it. —Wilson, p. 347

Even though we know and understand this, we are crafting a global disaster that may include our own extinction by destroying diversity at an enormous rate and on an enormous scale through overpopulation and industrialization, with consequent development and pollution. “The sixth great extinction spasm of geological time is upon us, grace of mankind” (Wilson, p. 343).

What can be done? Wilson recommends that we (1) survey the world’s fauna and flora, (2) create biological wealth (by bioeconomic analysis), (3) promote sustainable development (only), (4) save what remains, and (5) restore the wildlands (Wilson, p. 311-342).

I feel no hesitation in urging the strong hand of protective law and international protocols in the preservation of biological wealth, as opposed to tax incentives and marketable pollution permits. In democratic societies people may think that their government is bound by an ecological version of the Hippocratic oath, to take no action that knowingly endangers biodiversity. But that is not enough. The commitment must be much deeper—to let no species knowingly die, to take all reasonable action to protect every species and race in perpetuity. The government’s moral responsibility in the conservation of biodiversity is similar to that in public health and military defense. The preservation of species across generations is beyond the capacity of individuals or even powerful private institutions. Insofar as biodiversity is deemed an irreplaceable public resource, its protection should be bound into the legal canon. —Wilson, p. 342

It is especially important to understand the workings of the ecosystems and to protect especially those that are unique or unusual, such as those of the Tugaloo Mosaic.

—by John Garst

Doing What Comes Naturally: Marie Mellinger

By Margaret Shannon

In Georgia botanical circles, where strong personalities abound, one of the strongest is that of Marie Mellinger, a strawberry blond who, until recently, lived partway up Eastman Mountain near Tiger, in Rabun County. Marie is descended from a great-great-grandfather who was a noted German botanist and a mother who was both a gifted amateur botanist and an early feminist. Marie's husband, the late E. O. (Mel) Mellinger, was, until his retirement, a biologist with the U.S. Fish and Wildlife Service. She moved to Clayton in 1992 several months after Mel's death.

During their years on the mountain, Mel usually stayed home tending his beloved garden and looking after the cats while Marie heeded the call of the wild. "I'm a people person; Mel isn't," she would explain. Yet one close friend and associate characterizes Marie as basically shy, and Marie says of herself, "I think I can write what I often cannot express vocally."

Such judgments of her ability to communicate will astonish some persons who have seen her in action. In defense of nature, she can be absolutely fierce, and she is fast with the bon mot and, if provoked, the cutting remark. Just as easily, she slips into iambic cadences, speaking, when moved, like the poet she is.

Marie is more action than words, however. Years ago, tired of being snubbed in some academic and professional botanical circles because of her lack of a degree, Marie used her first term as president of the Georgia Botanical Society to expand membership to take in amateurs and all comers interested in native plants. Bot Soc began to flourish and become a happy meeting place for academic, amateur and professional.

Marie is a naturalist and free-lance consultant. She is well-known for her seminars at the Hambidge Center at Rabun Gap, has edited a collection of letters between legendary botanists J.K.



Photograph: Les Saucier

Small and Roland Harper and conducts wildflower courses at several Elderhostels every year.

She has had articles in numerous nature publications, has written a column for years for the *Clayton Tribune* in her hometown, has edited materials for the *Foxfire* quarterly and the *Foxfire* books, is author of some small, handy wildflower guidebooks and has fought enough battles against clear-cutting of forests to add up to a war. Several years ago, she joined in organizing Friends of the Mountains, now a sturdy guardian of north Georgia's natural resources. Marie has served as its president and each year chairs its Conservation Fair in Clayton.

Few can match Marie on plant identification in the field. She is one of Georgia's premier naturalists.

One of Marie's most prodigious achievements was heading the Botanical Society's compilation of county-by-county records of wild plant ranges in Georgia and then editing its *Atlas of the Vascular Flora of Georgia*, published in December 1984. With maps showing the range of 2,697 species, it is the most comprehensive such listing available.

Marie's poetic output seems to spring forth spontaneously. She often writes a poem to celebrate the season, to end a lecture or simply to express her joy in living things. She can even poke a little fun at botany, as: "Botanical nomenclature is really very crazy. *Chrysanthemum leucanthemum* is just a common daisy."

One of Marie's most famous feuds—with a prominent academic botanist—has come to an end, but she still feels strongly about the principles that were involved. One of the key

points is that she considers overcollection of native plant specimens for herbariums and for academic class projects to be environmental rape. "I think the time has come to stop taking a botany class out in the woods and you have ten botany students and each student collects ten specimens of a rare thing and you exterminate a whole colony for a herbarium," she said. "I think we should have progressed scientifically way beyond that point."

Marie has, in fact, advocated an end to the dictum that no species exists in Georgia unless substantiated by specimens in the University of Georgia herbarium. She had seen golden-seal, *Hydrastis canadensis*, three times in the state, yet ran into opposition when trying to get it placed on the first list of rare and endangered species. "I feel very strongly," she has said, "that if the bird people have come to accept sight records or photographs, there is no reason in the world why plant people can't."

Botanists who gather specimens to exchange with other botanists are also high on the Mellinger "enemies" list. One of her horror stories is about a Georgia botanist, a Ph.D. and all that, who, upon learning the location of a fine stand of *Dodecatheon meadia*, the shooting star, set forth and dug up sixty of them to press between paper and send off to other botanists, who in turn might go out and ruin other colonies of wildflowers in order to return the favor. To Marie, it is desecration.

It also distresses her that some people and some nurseries will advertise wildflowers for sale and then rob them from the woods to fill orders instead of propagating them. After many of her nature talks, Marie hands out native plant seeds collected in the wild. Better to plant a seed than to dig a plant.

Since the 1960s, a growing horde of naturalists and nature-lovers like Marie has been defending the flora and fauna of this world, fighting, demanding, shrill as jaybirds at times, prophets of doom, voices crying in the wilderness and about the wilderness. "Ecology" and "the environment" have been reinvented, making old definitions archaic. The voice of the botanist—the biologist—the naturalist—is heard in the land.

In Georgia, Marie Mellinger was in the vanguard—an idea whose time had come. She was born in Wisconsin and grew up on the

In defense of nature, she can be absolutely fierce; or slip into iambic cadences, speaking like the poet she is.

edge of a forest. She went to normal school and became a seventh and eighth grade teacher, but she had botany in her blood. She sat out World War II in a fire tower, watching the forests while the male foresters were gone to war. Along the way, at various times she ran a plant nursery with her father, absorbed the Potawatomi Indian culture and land ethic during a first marriage, worked with the mentally handicapped, did publicity for the Wisconsin Department of Conservation and took courses at universities in Wisconsin, Minnesota and Kentucky.

In 1959 she and husband Mel moved

South. Mel had been with the U.S. Fish and Wildlife Service since 1947, and his new station was the Savannah National Wildlife Refuge. Marie went to work for the Savannah Science Museum. When Coastal Plains summers sent her blood pressure plummeting, they looked for a place in the mountains, checking ads in the Market Bulletin (in which some of the pilfered wildflowers she abhorred were offered for sale also). "We came to Rabun County and saw the apple trees and the white pines and the trailing arbutus and the view of Rabun Bald and we said we'd take it," Marie said. "We never bothered to find out sensible things like whether we had a good water supply or whether the plumbing worked."

The house sat smack-dab on an unpaved mountain road, so close you could almost reach out and touch it as you drove by. A Mrs. Judson, an actress from New York, had built the place in the 1920s as a summer cottage. Mel and Marie added to it and made improvements, but essentially it remained a modest mountain home of pre-second-home character. For several years, Marie spent the summers there, and Mel commuted from Savannah on weekends. When he retired in 1967, they moved to the mountains for good.

Marie began working in 1965 for the state parks department on a pilot



Marie is well-known for leading botanizing forays on the trails at Hambidge Center at Rabun Gap. Her ever-present sense of wonder at nature is contagious.

program of nature trails and lectures. After seven years, she started freelancing as a naturalist and devoting untold unpaid hours to various crusades to protect the environment.

Inevitably there were clashes and controversies. One notable blowup occurred at a Georgia Conservancy convention in 1975 when Marie and a group of allies tried to get the organization to take a firm stand against clear-cutting. At the heart of the fight was the belief by Marie's group that the Conservancy was in danger of compromising itself by taking financial support from large corporations with suspect environmental agendas. Marie lost the argument, but stayed in the Conservancy to fight another day.

Photograph: Les Saucier

She is not a quitter. Her involvement with the Georgia Botanical Society is a textbook case in single-mindedness at work. First, she had to push her way into the organization. Membership was by invitation only, and she did not get invited. "I sat back and kept hoping they were going to ask me to join," she said. "I finally got up the nerve one day to ask to join. I can assure you that when I became president, that little requirement was shelved."

After she opened the door during her 1970-71 presidency, membership went from about 65 to 350 in five years. "We had very few active members outside of Atlanta," she said.

"I started an active campaign to make it a statewide organization." It was during this period that the annual wildflower pilgrimage, one of Bot Soc's most popular activities, began.

"I don't care if members know one plant from another, as long as they have an interest and come and support the Society," she said. "I always feel that sooner or later it rubs off on them." Marie's policy has worked. It has turned many an *aficionado* into an amateur botanist, and the larger, broader-based membership gave the Botanical Society new weight in environmental matters. She served another two-year term as president in 1983-84.

Injuries and health problems may have kept Marie away from some of the more strenuous botanizing forays in recent years, but her prowess as a field botanist remains unchallenged. Some

professional botanists might outperform her in the laboratory, but few can match her on plant identification in the field. One Bot Soc member tells of a field trip that Marie missed when he and another amateur, both of them excellent botanists, and a college botany professor ran into questions they couldn't answer. "We felt absolutely bereft without Marie," he said.

A special quality of Marie's is that she seems never to have lost her sense of wonder. A case in point is a particular mountain trail at Hambidge Center leading to a cove with a forest approaching the climax stage. She has

led scores of nature walks along that trail, but it never bores her.

Some years ago, for example, as she led a seminar group from Hambidge along that trail, she was as eager as the greenest greenhorn

and at awe, as always, at the bounty of the flora: the columbo, *Swertia caroliniensis*, a triennial, rare. ("It's a weirdie," Marie said.) Blue cohosh. Black cohosh. Broad beech fern. Bloodroot. Wild geranium. Trillium, hundreds, covering hillsides. Dutchman's pipe. Yellow violet. Wild hydrangea. A runner-type foamflower. Dead-man's fingers, a fungus. Monks-hood, another rarity. *Astilbe biternata*.

The trees were magnificent. A sugar maple perhaps a century old. The basswood, *Tilia americana*, a sure sign of the climax forest. A tremendous fallen chestnut, dead possibly fifty years, rich red-brown in color, the wood still sound.

At the end of the walk, the group sat down under a big beech by Bettys Creek. The beech is one of Marie's favorite trees, perhaps the favorite. She looked tense, a little drawn. She had compiled, from various sources, a sort of paean to trees, which she read:

Today I have grown taller from walking with trees....Trees are my friends. I never tire of them....Tell me the gladness which is spring, the realization which is summer, the plenty that is autumn, and the great silent hope which is winter....For who loveth not a tree hath not known God, or seen a miracle....I would not say that trees at all are of my blood and race, yet lingering where their shadows fall, I sometimes think I trace a kinship...."

She was crying, tears rolling down her weathered cheeks.

"We bought our place in the mountains because it bordered on a national forest," she has said. "Being

naturalists, Mel and I thought how wonderful to have a wilderness in our backyard for hiking, bird-watching, botanizing and so on. But the first thing we knew, the Forest Service was trading off the land behind us, so we protested long and loud and didn't do any good. They traded off and destroyed a beautiful valley full of butternuts, black walnuts—full of magnificent trees.

"I get very emotional over forests, because the forest means something special to me," Marie says. "From the time I was a little bitty girl, I lived on the edge of forests. The feeling I have about forests—well, it's just something you absorb when you live with a forest."

This article is based in large part on an article by Margaret Shannon in The Atlanta Journal and Constitution Magazine of August 24, 1975.

First Person Singular: My Triumph

By Vivian Emerson

There is the triumph of discovering your first walking fern, or native climbing fern or perhaps even the first bloodroot of the spring, when you are walking alone.

But for me there was a different triumph. Back in the dim Dark Ages, the Georgia Botanical Society was a small Atlanta-based organization. Norma Seiferle, whom I had known through the Georgia Appalachian Trail Club, asked me if I thought anyone would be interested in learning how to key flowers.

A key is a wonderful method for unlocking the puzzle—what flower is this? Done step by step, usually with a choice of two descriptions, the exact genus and species are found. Keys are particularly good for people like me whose memory for names is sadly lacking.

But I digress. Elizabeth Hall and I, neither of us Botanical Society members, wanted to learn, and so did about six Bot Soc members. So we met at the Seiferles' home one night a week during January and February. Under Norma's guidance we struggled with Fernald's *Gray's Manual of Botany*.

Fortunately, the winter was mild so that winter cresses, hepatica, dandelions, trout lilies and violets obliged us with their blooms. All flowers came from Norma's garden. Elizabeth and I were fascinated and joined the Bot Soccers. (Incidentally, that phrase was coined

by Carol Ruckdeschel a few years later.)

By this time my husband and I had purchased five acres on Lake Lanier. The property consisted of an old pasture, rapidly turning into broom sedge and brambles. From this environment came my puzzles, flowers I did not know. For most of them picture books sufficed, but there was one real challenge: a maroon-colored flower growing on a vine. By this time I had discovered Radford, Ahles & Bell's *Manual of the Vascular Flora of the Carolinas*. Equipped with hand lens and a razor blade for dissecting, and with one finger in the glossary for interpreting the baffling botanic terminology, I worked diligently for most of a hot, sunny afternoon.

Triumph! It was *Matelea carolinensis*, a climbing milkweed called spiny-pod. I had keyed a flower successfully!



Illustration: Bill Close

Site-seeing: Whitmore's Bluff

By Richard Ware

While I have lived my entire life in Floyd County, and resided during my early years only a couple of miles downstream from Whitmore's Bluff, it took a Georgia Botanical Society field trip to Rome to open my eyes to the area. I had heard stories of a bluff farther upriver for many years, but it was not until becoming an amateur botanist and seeing the wonderful variety of plants on Black's Bluff, on the Coosa river south of Rome, that I had an intense desire to explore the Whitmore's Bluff area.

About three years ago a field trip to Rome was planned. On Saturday I led a very enthusiastic group of Bot Soccers to Black's Bluff. On Sunday a canoe trip was planned down the Oostanaula river with a stop at Whitmore's Bluff, although the actual name of the bluff was not known to us at that time. I was not able to canoe that day, but was determined to find a way to reach Whitmore's later by land.

The next weekend I purchased a U.S. Geological Survey map for the area. It was easy to see that Bells Ferry Road was the nearest to the area. I stopped at the home of Vivian, Lamar and Tara Varner and their uncle, Clinton Culberson, and asked if they had heard of the Bluff. Lamar, a student at Model High School, said, "Sure, I go there all the time; come on, I'll take you there." Lamar forgot about the ages of the people trying to keep up with him, and by the time we reached the top of the bluff I had huffing and

puffing. But the scenic view and the numerous wildflowers made it worthwhile.

Whitmore's Bluff is approximately four miles northeast of Rome as the crow flies, but it has been described as being as much as nine miles up the Oostanaula river from Rome. While Whitmore's has not received the publicity that Black's Bluff has lately, it is quite evident that it was as popular or possibly even more so in the past. Newspaper accounts tell of houseboat excursions to Whitmore's Bluff and Island for picnics and exploring by Scouts and others. According to one such article, "Whitmore's Bluff is a beautiful promontory which projects a shaggy chin over the winding Oostanaula. Its face is gray with a mass of native boulders which contain shelves and landing places. The top affords a fine view of the surrounding terrain. At the base of the rocky slope is Mitchell's Cave, from which issues in gay little cascades, the purest spring water" (*Tribune-Herald*, April 25, 1921, as quoted in Roger D. Aycock's *All Roads To Rome*, 1981). It must be pointed out that some of Aycock's descriptions about the bluff overhanging the river would not normally be accurate today (except in cases of flooding), because a formerly operational lock and dam is no longer in use, consequently the water level is lower.

Whitmore's Bluff is a limestone bluff rivaling Black's Bluff (see 1992

issue of *Tipularia*, Site-seeing: Black's Bluff) in species and beauty, and is relatively undisturbed. It is actually a long ridge containing three separate rock walls. The northernmost face is a straight drop to Mitchell's Cave below. From the top of the bluff to the riverbank is approximately 250 feet. The Bluff has many smaller caves in addition to Mitchell's. On our last visit to Mitchell's Cave we discovered several small bats in the cave.

Whitmore's has a tremendous number of species of wildflowers, trees and shrubs. One of the most unusual is pachysandra or Allegheny spurge (*Pachysandra procumbens*), which is reported from only four or five counties in Georgia, and is, according to the late Bus Jones, one of the largest populations he'd ever seen. The area also contains large-flowered skullcap (*Scutellaria montana*), located in only two counties in Georgia, and *Trillium lancifolium*, located in four.

The following is an incomplete list of plants growing on Whitmore's Bluff; a complete study has not been made:

heatica (*Hepatica acutiloba*)
green violet (*Hybanthus concolor*)
golden ragwort (*Senecio aureus*)
columbine (*Aquilegia canadensis*)
stonecrop sedum (*Sedum ternatum*)
phacelia (*Phacelia bipinnatifida*)
toadshade trillium (*Trillium cuneatum*)
early saxifrage (*Saxifraga virginiensis*)
cut-leaved toothwort (*Dentaria laciniata*)
toothwort (*Dentaria diphylla*)
slender toothwort (*Dentaria heterophylla*)
wild potato-vine (*Ipomoea pandurata*)
spiderwort (*Tradescantia virginiana*)
woods vetch (*Vicia hugeri*)
dwarf crested iris (*Iris cristata*)

sweet shrub (*Calycanthus floridus*)
early azalea (*Rhododendron periclymenoides*)
yellow star-grass (*Hypoxis hirsuta*)
star chickweed (*Stellaria pubera*)
maple-leaf viburnum (*Viburnum acerifolium*)
heart-leaf (*Hexastylis arifolia*)
wild geranium (*Geranium maculatum*)
flowering spurge (*Euphorbia corollata*)
alumroot (*Heuchera Americana*)
foam flower (*Tiarella cordifolia*)
bloodroot (*Sanguinaria canadensis*)
rue-anemone (*Thalictrum thalictroides*)
squawroot (*Conopholis americana*)
black cohosh (*Cimicifuga racemosa*)
dwarf larkspur (*Delphinium tricorne*)
violet wood-sorrel (*Oxalis violacea*)
Solomon's-seal (*Polygonatum biflorum*)
pipsissewa or spotted wintergreen
(*Chimaphila maculata*)
devil's walking stick (*Aralia spinosa*)
hydrangea (*Hydrangea arborescens*)
mockorange (*Philadelphus inodorus*)
serviceberry (*Amelanchier arborea*)
purple cliffbrake (*Pellaea atropurpurea*)
walking fern (*Asplenium rhizophyllum*)
shooting star (*Dodecatheon meadia*)

Here are a few of the tree species at Whitmore's Bluff:

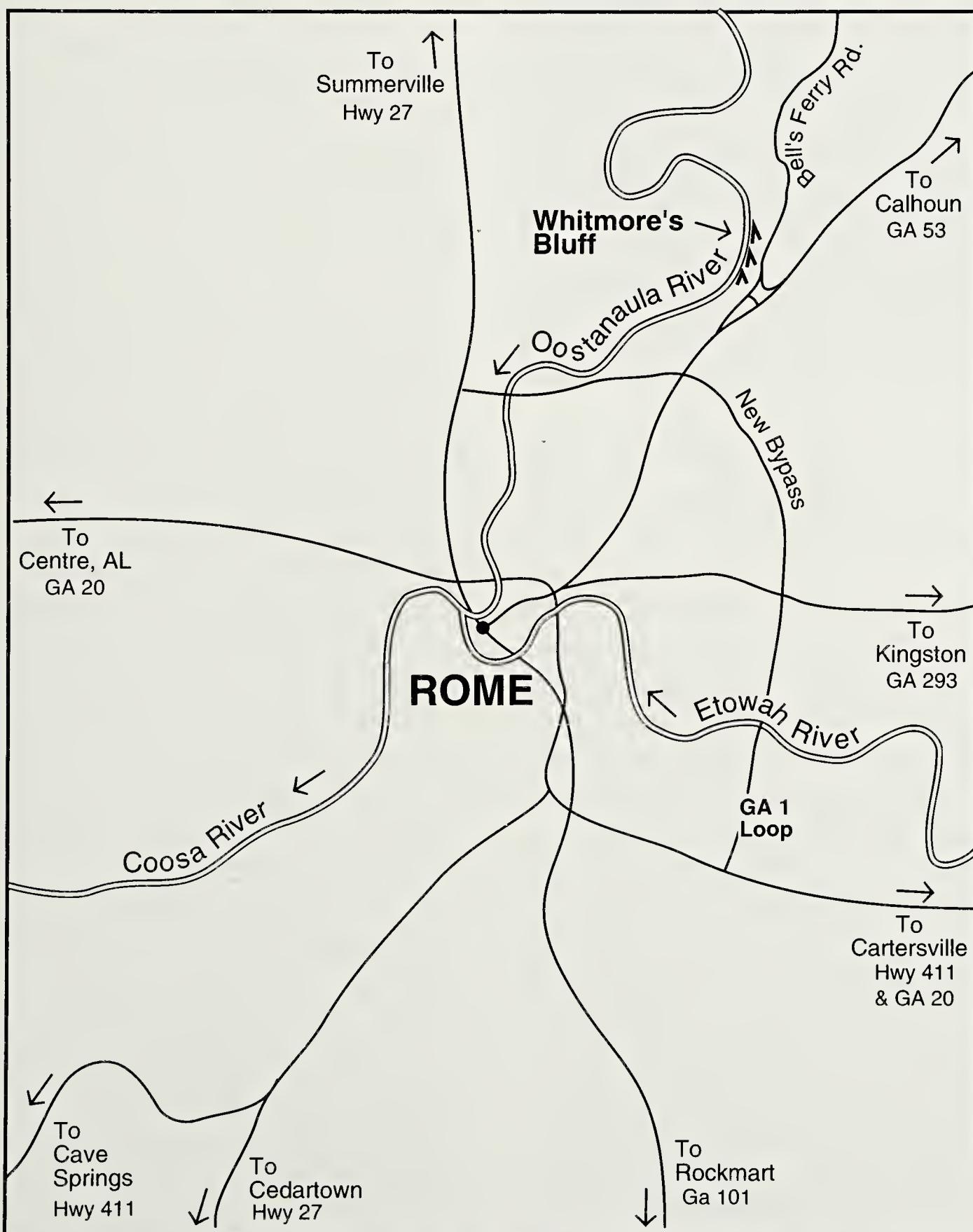
sugar maple (*Acer saccharum* or *A. barbatum*)
tuliptree (*Liriodendron tulipifera*)
chinkapin oak (*Quercus muehlenbergii*)
American elm (*Ulmus americana*)
northern red oak (*Quercus rubra*)
rebdub (*Cercis canadensis*)
chestnut oak (*Quercus montana*)
red cedar (*Juniperus virginiana*)
white ash (*Fraxinus americana*)
sassafras (*Sassafras albidum*)
Virginia pine (*Pinus virginiana*)
white oak (*Quercus alba*)
American beech (*Fagus grandifolia*)
bitternut hickory (*Carya cordiformis*)

southern shagbark hickory (*Carya carolinae-septentrionalis*)

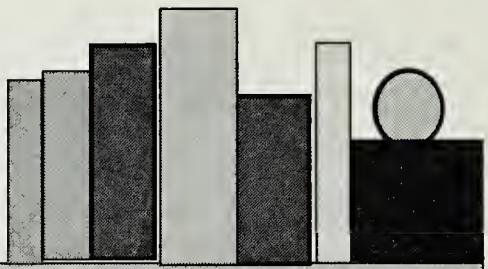
At the present time, Whitmore's Bluff is privately owned and could be logged or sold for building lots or otherwise destroyed at any time. I have attempted to interest others with the need to preserve this area and have

taken a Department of Natural Resources biologist there on one occasion. Hopefully Bot Soc field trips there will generate more interest.

Anyone wishing to visit Whitmore's Bluff may contact Richard Ware (day: 1-706-235-6041, night: 1-706-232-3435).



Map of Rome environs and location of Whitmore's Bluff on the Oostanaula River



Georgia: Images of Wildness

By James Randklev, nature photographer, edited by Sharon Worsham; Westcliffe Publishers, Englewood, Colorado, 1992. Pp. 128, 115 color photographs. Hard (\$29.95) and soft (\$19.95) cover.

Our state of Georgia has been blessed with a variety of beautiful and varied habitats, from the mountains to the seashore. In *Georgia, Images of Wildness*, James Randklev has captured both the glory and the uniqueness of our state. His photographs carry us through the seasons, from the icicles of winter to the first violets of spring, through the lush and serene green of summer to autumn's falling leaves. The wilder and more untouched areas of Georgia are ably displayed. In his preface, Randklev writes of his awe and wonder, experienced through the mountain summits, the canyons, the magic of waterfalls and running water and the uniqueness of the granite outcrops.

In the forward, Eugene Odum speaks of the changes that have

occurred in the Georgia landscapes, many he believes "for the better!" But he also warns of incipient dangers such as population growth and tells of the increasing need for more environmental education. Odum also points out that most natural areas occur in the mountains or at the sea shore, and that there is a serious need for more such areas in the urban Atlanta area.

Following these introductory statements, managing editor (and Bot Soccer) Sharon Worsham organized the body of work into six geographical sections, each described in an essay by a different well-known Georgia ecologist and illustrated by Randklev's stunning photographs. In addition, Worsham wrote the descriptive commentaries that accompany each photograph. She has done a monumental job tying photographs and essays together.

The essays give one a taste of each geographical area of Georgia. Charles Wharton writes of the mountains: "to climb a high mountain is to travel 1000 miles north, and 20,000 years back in

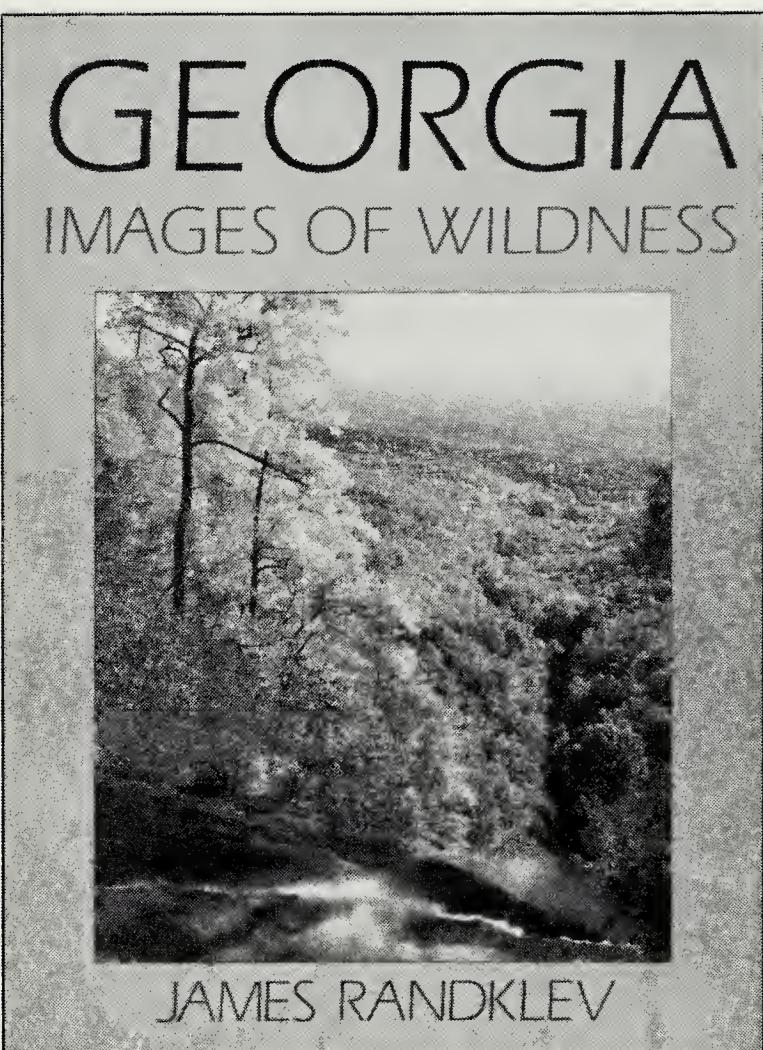
time....the environmental importance of the entire bioregion lies in the mountain forests, primarily in the storage and management of water." Of the Ridge and Valley Province and the Cumberland Plateau, Dr. Philip Greear tells of the "tectonic forces that...created the land forms, and of the very unique natural environments, and the unusual flora they contain."

The Piedmont is described by Harvey Ragsdale as that vast, rolling terrain that ends at the fall line. He wrote of the striking contrast of granite outcrops and wandering rivers, and of the great diversity within and abuse of the Piedmont forests.

Ornithologist Milton Hopkins writes of the Upper Coastal Plain: flatlands and pine forests with some unusual sandstone outcrops such as Broxton Rocks, the wetlands known as the Carolina Bays and the gulleys of Providence Canyon. Milton also explores the watersheds of the Ogeechee and Ocmulgee Rivers. Of the lower Coastal Plain, Robert Humphries tells of the pine flatwoods, ancient marine terraces, the great wet pocket known as the Okefenokee Swamp, and all the special areas fed by the black water rivers—the Satilla, the Alapaha and the Withlacoochee.

The descriptions of the barrier islands and estuaries by Richard Weigart are outstanding: the jeweled charm of the islands adjoining the ocean, the elemental beauty of the dunes and salt marshes, the richness of the plant and animal life found there. He stresses the conflict between those who wish to develop the islands and those who wish to protect them as a natural heritage.

As good as the essays are, botanists will delight especially in the details of



fungi, lichens, mosses, ferns and wild flowers found in Randklev's photographs. The only criticism I have heard was the "too bright color of the Panther Creek phlox." My personal favorite pictures include the Pine Mountain Ridge, the live oak skeletons on Cumberland Island, the evening light on the Okefenokee and the shorebird tracks, again on Cumberland.

On every page, through photos and text, the message is clear—we must protect our wonderful natural heritage and expand it wherever possible for future generations to enjoy. Randklev speaks of the definite need to protect Georgia's natural heritage and delicate ecosystems, quoting Henry David Thoreau: "in wildness is the preservation of the world."

Reviewed by Marie B. Mellinger

Vascular Flora of the Southeastern United States

Volume 1: Asteraceae, by Arthur Cronquist, The New York Botanical Garden, 1980.

Volume 3, part 2: Leguminosae (Fabaceae), by Duane Isely, Iowa State University, 1990.

The University of North Carolina Press, Chapel Hill. Each is \$35.00.

Now there are two works in this many-volume-to-be set, but a look at the bibliographic information above leads to questions. What happened to volume 2, and to volume 3, part 1? And why are there ten years between publication dates? The answers to these questions reflect the hard work of producing a modern flora. It takes a long time and extraordinary dedication to complete such a daunting task. We should be happy to have even these two volumes with which to work, when we consider that the goal of the complete series is to bring up-to-date the entire flora of such an incredibly vast and varied area—from the southeast, west to the prairies and north to the terminal moraines. Most of us are familiar with the modern flora most widely used in this region: Radford, Ahles and Bell's *Manual of the Vascular Flora of the Carolinas* (1968), and, as Georgians, are fully aware of its limitations for our area. Therefore, any modern work that will fully cover our state is welcome, and, because of the much greater range of this work, all the better.

That large geographic range is the single greatest advantage of this flora. With such complete coverage, it is

highly unlikely that one will encounter a plant that is not in these books (except on the fringes of the range), and, if one can work with the keys, identification is made more certain. There is great comfort in having such a large area included, minimizing the possibility of finding some unusual plant from outside the range. The difficulty of such a large range is that there are many more species in the keys and plant descriptions that must be worked through.

The verbal descriptions of plant ranges are excellent and will provide significant help even if the keys prove difficult. For example, if we here in Georgia key to a plant that occurs only in Arkansas, we can safely assume we have made at least one wrong turn in the keys. If our plant is truly unusual but occurs somewhere in the southeast, we will find it here. Many of us have had to utilize Small's *Manual of the Southeastern Flora* to get this kind of broad coverage, but Small's proclivity to split, split and split again, the older nature of his work, and the use of outdated American rules of nomenclature make Small hard to use. These new volumes bring us up to date.

As a part of a planned series, both volumes follow essentially the same format. The keys are exceptionally thorough, and all entries are numbered and indented. The species descriptions are much longer than those in smaller works, and they often contain information on related or easily confused species. Both works have

excellent writing styles that, while using a technical vocabulary, are not beyond the interested lay person (although a botanical dictionary would be good to have handy).

There are two things not included in these volumes that would be welcome: line drawings and range maps. Both

would add to the cost and number of pages but would be a great advantage, making the books more useful to more people.

We now wait for more volumes!

Reviewed by Scott Ranger



Errata

We regret that errors were made in Henrietta L. Chambers' article, "More about Picky Pycnanthemums," in the 1992 issue of *Tipularia*. There were three errors in Table 2, page 23:

- 1) Boomhour recognized two varieties: *P. incanum* var. *loomisii* and *P. pycnanthemooides* var. *viridifolium*.
- 2) Chambers recognized all the taxa at the species level (no varieties or subspecies).
- 3) Hamer has recognized three subspecies of *P. incanum*: *P. incanum* ssp. *incanum*, *P. incanum* ssp. *loomisii* and *P. incanum* ssp. *pycnanthemooides*.

We encourage you to make these changes in your 1992 issue by clipping or copying the corrected table below and affixing it over the previous one.

GRANT & EPLING	BOOMHOUR	CHAMBERS	HAMER
<i>P. albescens</i>	<i>P. albescens</i>	<i>P. albescens</i>	<i>P. albescens</i>
<i>P. curvipes</i>	<i>P. curvipes</i>	<i>P. curvipes</i>	<i>P. curvipes</i>
<i>P. incanum</i>	<i>P. incanum</i>	<i>P. incanum</i>	<i>P. incanum</i>
			ssp. <i>incanum</i>
<i>P. loomisii</i>	<i>P. incanum</i> var. <i>loomisii</i>	<i>P. loomisii</i>	<i>P. incanum</i>
			ssp. <i>loomisii</i>
<i>P. tullia</i>	<i>P. pycnanthemooides</i>	<i>P. pycnanthemooides</i>	<i>P. incanum</i>
			ssp. <i>pycnanthemooides</i>
<i>P. puberulum</i>	<i>P. pycnanthemooides</i>	<i>P. pycnanthemooides</i>	<i>P. incanum</i>
			ssp. <i>pycnanthemooides</i>
<i>P. viridifolium</i>	<i>P. pycnanthemooides</i> var. <i>viridifolium</i>	<i>P. pycnanthemooides</i>	<i>P. incanum</i>
			ssp. <i>pycnanthemooides</i>
<i>P. floridanum</i>	not included	<i>P. floridanum</i>	<i>P. floridanum</i>
<i>P. clinopodioides</i> *	<i>P. clinopodioides</i>	<i>P. clinopodioides</i>	<i>P. clinopodioides</i>

* Recognized but not placed in Incanum Group

Grant & Epling, 1943. Boomhour, 1941. Chambers, 1961a & Chambers and Chambers, 1971. Hamer (Dissertation in progress)

Table 2: Past and Current Circumscriptions of Incanum Group taxa.

